THE

AMERICAN GAS-LIGHT JOURNAL.

THE OFFICIAL GAZETTE OF

LIGHT, HEAT, WATER SUPPLY, AND SEWERAGE.

Rooms—No. 39 Nassau Street, cor. Liberty Street, opposite the Post-Office, New York.

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The Kerosene patents, from which the coal oil business in the United States originated, were granted to Dr. Gesner, Chemist and Geologist.

MISCELLANEOUS.

WOODEN TRAYS FOR GAS-PURIFIERS.—JOHN L. CHEESMAN, No. 147 Avenue C, near Tenth street, New York, manufactures his Patent WOODEN TRAYS for GAS-PURIFIERS, *cut out of the solid wood*, superior to the ordinary iron plates, cheaper and more durable. The attention of Gas Companies and Engineers is called to this improvement, which has been adopted by the following Gas-Works:

Albany, N. Y.	Manhattan, N. Y. City.
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Williamsburgh, N.Y.,	Worcester, Mass.

See engravings on page 148, vol. II.

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PATENT PREPARED WOOD-PIPE for Gas Mains.—Wm. Stephenson would call the attention of Gas Companies and Engineers to his Patent Prepared Wood Gas-Pipe. This Pipe is prepared in a way so as to effectually prevent its decay, and has been proven to be superior to Iron pipe in three towns where he has erected Gas-Works.

The cost of the Pipe, and the facility with which it can be laid, and *also its not being subject to expansion* and contraction by change of temperature, render it *entirely free from leakage;* there is also less condensation than in Iron pipe. These are among the advantages gained by the use of this Pipe, and are sufficient to recommend it to the favorable consideration of Gas Companies and Engineers; and it is considered, by those who have examined it, as a most valuable improvement.

A sample of this pipe may be seen at the rooms of the AMERICAN GAS-LIGHT JOURNAL, No. 39 Nassau street, New York; and further information, with reference to this Pipe, may be obtained by application to the Patentee,

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GAS FIXTURES TO BE SOLD, at Wholesale Prices.—In consequence of alterations in his Store, the subscriber is obliged to dispose of his entire stock of GAS FIXTURES. Those wishing to purchase at very low prices will do well to call. Gas Fixtures removed. Gas fitting executed in all its branches.
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References:—Gas-Light Works, Buffalo, N. Y.
" " Cleveland, O
" " Chicago, Ill.

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For engravings, see American Gas-Light Journal for June, 1860, page 245. Address the Patentee. JOHN P. KENNEDY, Trenton, N. J.

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See also certificates from Cincinnati, O., and Louisville, Ky. Gas-Works in same number, page 208. Address, JOHN WALTON,
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Samples of the above castings can be seen at the Rooms of the American Gas-Light Journal.

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ARTESIAN WELL PIPES,

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References.
Croton Aqueduct dept., N. Y.
Manhattan Gas Lt. Co., N. Y.
Brooklyn Water dept., N. Y.
Brooklyn Gas Lt. Co., N. Y.
Citizens' Gas Lt. Co., Brooklyn, N. Y.

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J. K. Brick, Esq., Eng'r Brooklyn Gas Co. "
Messrs. Elliman Brothers, New York.
F. T. Willis, Esq., Pres. Savannah Gas Co.
J. A. Sabbaton, Esq., Eng'r Man. Gas Co., N. Y.
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SCAMMON'S GAS-APPARATUS for Private Residences, Factories, Hotels and Cities. See engravings of Rosin and Coal Gas-Works in American Gas-Light Journal for Dec. 1, 1860, pages 179 and 180.

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References by permission:

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Aaron Claflin, Esq., "
A. B. Wood, "
George Bliss, Esq., N. Y., Pres. M. S & N. I. R. R. Co.
Geo. M. Atwater, Esq., Springfield, Mass.
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Arapahoe County.

Auraria, Montana.

Atchison County.

Atchison, Eden, Huron, Lancaster, Monrovia, Mount Pleasant, Pardee, Port William, Sumner.

Bourbon County.

Barnesville, Cato, Dayton, Fort Scott, Hathaway's, Mapleton, Marmaton, Osage, Turkey Creek, Xenia.

Breckinridge County.

Agnes City, Allen, Emporia, Forest Hill, Orleans, Plymouth, Toledo, Waterloo, Waushara.

Brown County.

Carson, Claytonville, Hamlin, Hiawatha, Kennekuk, New Eureka, Nohart, Padonia, Powhatan, Pony Creek, Robinson.

Butler County.

Byard, Chelsea.

Calhoun County.

Holton, Indianola.

Coffee County.

Burlington, Camp Creek, Le Roy, Nashville, Neosho City, Ottumwa.

Davis County.

Ashland, Kenton, Riley City, Zeandale.

Doniphan County.

Charlestown, Doniphan, Elwood, Geary, Green Top, Highland, Iowa Point, Lafayette, Palermo, Rogersville, Troy, Walnut Grove, Wathena, Wenona, White Cloud.

Douglas County.

Big Springs, Black Jack, Clinton, Davis, Eudora, Franklin, Kanwaka, Lawrence, Lecompton, Marion, McKinney, Prairie City, Palmyra, Twin Mound, Wakarnsa.

Franklin County.

Appanoose, Centropolis, Hickory Creek, Minneola, Ohio City, Peoria, Shermansville.

Greenwood County.

Eureka, Pleasant Grove.

Jefferson County.

Crooked Creek, Grasshopper Falls, Kaw City, Middletown, Mount Florence, Oskaloosa, Ozawkie, Rising Sun, Shields, Winchester.

Johnson County.

Gardner, Lexington, Hayesville, Hibbard, Monticello, Olathe, Shawnee, Spring Hill, Squiresville.

Leavenworth County.

Delaware City, Easton, Kickapoo City, Leavenworth City, Quindaro, Wyandott.

Linn County.

Blooming Grove, Brooklyn, Centreville, Hawkswing, Hillsborough, Jackson, Moneka, Mound City, Oakwood, Paris, Rovella, Twin Springs.

Lykins County.

Lyons, Miami Village, Midway, New Lancaster, Osawatomie, Paola, Stanton.

Madison County.

Hartford, Italia, Madison.

Marshall County.

Barrett, Bennett's Station, Marysville, New Dayton, Nottingham, Vermillion City.

McGhee County.

Brushville, Salisbury, Spring City.

Nemaha County.

Albany, America, Ash Point, Capioma, Central City, Clear Creek, Pleasant Spring, Richmond, Sabetha, Seneca.

Pottawatomie County.

Eldon, Unadilla, Westmoreland.

Richardson County.

Wabaunsee.

Riley County.

Henryville, Junction City, Kansas Falls, Manhattan, Ogden, Randolph.

Shawnee County.

Auburn, Burlingame, Mairestown, Richasdson, Richland, Ridgeway, Tecumseh, Topeka, Walton, Williamsport, Wilmington.

Weller County.

Superior.

Wise County.

Cottonwood Falls, Council Grove.

Woodson County.

Belmont, Neosho Falls.

Counties Unknown.

Beach Valley, Catholic Mission, Coraville, Fort Leavenworth, Fort Riley, Ottawa Creek, Rock Creek, Sac and Fox Agency, Saint Mary's Mission, Secondine, Whitehead.

THE CHEMICAL HISTORY OF A CANDLE.

BY PROFESSOR FARADAY.

A course of Six Lectures (adapted to a Juvenile Audience) Delivered before the Royal Institution of Great Britain.

LECTURE V.

OXYGEN PRESENT IN THE AIR—NATURE OF THE ATMOSPHERE—ITS PROPERTIES—OTHER PRODUCTS FROM THE CANDLE—CARBONIC ACID—ITS PROPERTIES.

We have now seen that we can produce hydrogen and oxygen from the water that we obtained from the candle. Hydrogen, you know, comes from the candle, and oxygen, you believe, comes from the air. But then you have a right to ask me, "How is it that the air and the oxygen do not equally well burn the candle?" If you remember what happened when I put a jar of oxygen over a piece of candle, you recollect there was a very different kind of combustion to that which took place in the air. Now, why is this?—it is a very important question, and one I shall endeavor to make you understand; it relates most intimately to the nature of the atmosphere, and is most important to us.

We have several tests of oxygen besides the mere burning of bodies; you have seen a candle burnt in oxygen, or in the air; you have seen phosphorus burnt in the air, or in oxygen, and you have seen iron filings burnt in oxygen. But we have other tests besides these, and I am about to refer to one or two of them for the purpose of carrying your conviction and your experience further. Here you have a vessel of oxygen. I will show its presence to you. If I take a little spark and put it into that oxygen, you know by the experience you gained the last time we met, what will happen—if I put that spark into the jar, it will tell you whether we have oxygen here or not. Yes! We have proved it by combustion; and now, here is another test for oxygen, which is a very curious and useful one. I have here two jars full of gas, with a plate between them to prevent their mixing; I take the plate away, and the gases are creeping one into the other. "What happens?" say you, "they together produce no such combustion as was seen in the case of the candle." But see how the presence of oxygen is told by its association with this other substance. What a beautiful curious gas I have obtained in this way, showing me the presence of the oxygen! In the same way we can try this experiment by mixing common air with this test gas. Here is a jar containing air—such air as the candle would burn in—and here is a jar or bottle containing the test gas. I let them come together over water, and you see the result; the contents of the test bottle are flowing into the jar of air, and you see I obtain exactly the same kind of action as before, and that shows me that there is oxygen in the air, the very same substance that has been already obtained by us from the water produced by the candle. But then, beyond that, how is it that air does not burn the candle as well as oxygen will? We will come to that now. I have here two jars; they are filled to the same height with gas, and the appearance to the eye is alike in both, and I really do not know at present which of these jars contains oxygen and which contains air, although I know they have previously been filled with these gases. But here is our test gas, and I am going to work with the two jars, in order to examine whether there is any difference between them in the quality of reddening this gas. I am now going to turn this test gas out into one of the jars, and observe what happens:—There it is reddening, you see; there is then oxygen present. We will now test the other jar, but you see this is not so bright, not so red, not so distinct, as the first; and, further, this curious thing happens, if I take these two gases and shake them together well with water, we shall absorb the red gas; and then if I put in more of this test gas, and shake again, we shall absorb more, and I can go on as long as there be any oxygen present to produce that effect. If I let in air, it will not matter, but the moment I introduce water, the red gas disappears, and I may go on in this way, putting in more and more of the test gas, until I come to something left behind which will not redden by the use of that particular body that rendered the air and the oxygen red. Why is that? You see in a moment it is because there is, besides oxygen, something else present which is left behind. I will let a little more air into the jar, and if it turns red, you will know that some of that reddening gas is still present, and that, consequently, it was not for the want of this producing body that that air was left behind.

Now, you will begin to understand what I have got to say. You saw that when I burnt phosphorus in a jar, as the smoke produced by the phosphorus and the oxygen of the air condensed, it left a good deal of gas unburnt, just as this red gas left something untouched—there was, in fact, this gas left behind which the phosphorus cannot touch, which the reddening gas cannot touch, and this is something which is not oxygen, and yet is part of the atmosphere.

So that is one way of opening out air into the two things of which it is composed—oxygen, which burns our candles, our phosphorus, or anything else, and this other substance, which will not burn them. This other part of the air is by far the larger part. Now, this substance is a very curious thing when we come to examine it; it is remarkably curious, and yet you say, perhaps, that it is very uninteresting. It is uninteresting, in some respects, because of this—that it shows no bright appearance of combustion. If I test it with a taper, as I do oxygen and hydrogen, it does not burn like hydrogen, nor does it make the taper burn, like oxygen. Try it in any way I will, it does neither the one thing or the other; it will not take fire; it will not let the taper burn; it puts out the combustion of anything. There is nothing that will burn in it in common circumstances. It does not smell; it is not sour; it does not dissolve in water; it is neither an acid or alkali; it is as indifferent to all our organs as it is possible for a thing to be. And you might say, "It is nothing; it is not worth chemical attention; what does it do in the air?" Ah! then come our beautiful and fine results shown us by an observant philosophy. Suppose, in place of having nitrogen, or nitrogen and oxygen, we had pure oxygen as our atmosphere. What would become of us? You know very well that a piece of iron lit in a jar of oxygen goes on burning to the end. When you see a fire in an iron grate, imagine where the grate would go to if the whole of the atmosphere were oxygen. The grate would burn up more powerfully than the coals; for the iron of the grate itself is even more combustible than the coals which we burn in it. A fire put into the middle of a locomotive would be a fire in a magazine of fuel, if the atmosphere were oxygen. The nitrogen lowers it down and makes it moderate and useful for us, and then with all that it takes away with it the fumes that you have seen produced from the candle, disperses them throughout the whole of the atmosphere, and carries them away to places where they are wanted to perform a great and glorious purpose of good to man; for the sustenance of vegetation, and thus does a most wonderful work, although you say, on examining it, "Why, it is a perfectly indifferent thing." This nitrogen, in its ordinary state, is an inactive element; no action short of the most intense electric force, and then in the most infinitely small degree, can cause the nitrogen to combine directly with the other element of the atmosphere, or with other things round about it; it is a perfectly indifferent, and therefore to say, a safe substance.

But before I take you to that result, I must tell you about the atmosphere itself; I have written on this diagram the composition of one hundred parts of atmospheric air;

	Bulk.	Weight.
Oxygen,	20	22.3
Nitrogen,	80	77.7
	100	100.0

It is a true analysis of the atmosphere, so far as regards the quantity of oxygen and the quantity of nitrogen present. By our analysis, we find that 5 pints of the atmosphere contain only 1 pint of oxygen, and 5 pints or 4 parts of nitrogen by bulk. That is our analysis of the atmosphere. It requires all that quantity of nitrogen to reduce the oxygen down, so as to be able to supply the candle properly with fuel, so as to supply us with an atmosphere which our lungs can healthily and safely breathe; for it is just as important to make the oxygen right for us to breathe, as to make the atmosphere right for the burning of the fire and the candle.

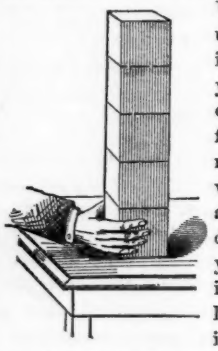
But now for this atmosphere. First of all, let me tell you the weight of these gases. A pint of nitrogen weighs 10 4-10 grains, or a cubic foot weighs 1 1-6 oz. That is the weight of the nitrogen. The oyygen is heavier; a pint of it weighs 11 9-10 grains, and a cubic foot weighs 1¼ oz. A pint of air weighs about 10 7-10 grains, and a cubic foot 1 1-5 oz.

You have asked me several times, and I am very glad you have, "How do you weigh gases?" I will show you; it is very simple, and easily done. Here is a balance and here is a copper bottle made as light as we can, consistent with due strength, turned very nicely in the lathe, and made perfectly air-tight, with a stopcock which we can open and shut, which at present is open, and, therefore, allows the bottle to be full of air. I have here a nicely adjusted balance in which I think the bottle, in its present condition, will be balanced by the weight on the other side. And here

is a pump by which we can force the air into this bottle, and with it we will force in a certain number of volumes of air as measured by the pump. [Twenty measures were pumped in.] We will shut that in and put it in the balance. See how it sinks; it is much heavier than it was. By what? By the air that we have forced into it by the pump. There is not a greater *bulk* of air, but there is the same bulk of *heavier* air, because we have forced in air upon it. And that you may have a fair notion in your mind as to how much this air is, here is a jar full of water. We will open that copper vessel into this jar, and let the air return to its former state. All I have to do now is to screw them tightly together, and to turn the taps, when there, you see, is the bulk of the twenty pumps of air which I forced into the bottle; and to make sure that we have been quite correct in what we have been doing, we will take the bottle again to the balance, and if it is now counterpoised by the original weight, we shall be quite sure we have made our experiment correctly. It is balanced; so, you see, we can find out the weight of the extra volumes of air forced in in that way, and by that means we are able to ascertain that a cubic foot of air weighs 1 1-5 oz. But that small experiment will by no means convey to your mind the whole literal truth of this matter. It is wonderful how it accumulates when you come to larger volumes. The bulk of air [a cubic foot] weighs 1 1-10 oz. What do you think of the contents of that box above there which I have had made for the purpose? The air which is within that

box weighs one pound—a full pound, and I have calculated the weight of the air in this room—you would hardly imagine it, but it is above a ton. So rapidly do the weights rise, and so important is the presence of the atmosphere, and of the oxygen, and the nitrogen in it, and the use it performs in conveying things to and fro, from place to place, and carrying bad vapors to places where they will do good instead of harm.

Having given you that little illustration, with respect to the weight of the air, let me show you certain consequences of it. You have a right to them, because you would not understand so much without it. Do you remember this kind of experiment: have you ever seen it? Suppose I take a pump somewhat similar to the one I had a little while ago to force air into the bottle, and suppose I place it in such a manner that by a certain arrangement I can apply my hand to it. My hand moves about in the air so easily that it seems to feel nothing, and I can hardly get velocity enough by any motion of my own in the atmosphere to make sure that there is much resistance to it. But when I put my hand here [on the air-pump receiver, which was afterwards exhausted], you see what happens. Why is my hand fastened to this place, and why am I able to pull this pump about? And see! how is it that I can hardly get my hand away? Why is this? It is the weight of the air—the weight of the air that is above. I have another experiment here which I think will explain to you more about it.



When the air is pumped from underneath the bladder which is stretched over this glass, you will see the effect in an other shape; the top is quite flat at present, but I will make a very little motion with the pump, and now look at it—see how it has gone down, see how it is bent in; you will see the bladder go in more and more until, at last, I expect it will be driven in and broken by the force of the atmosphere pressing upon it [the bladder, at last, broke with a loud report]. Now, that was done entirely by the weight of the air pressing upon it, and you can easily understand how that is. The particles that are piled up in the atmosphere stand upon each other, as these five cubes do; you can easily conceive that these five cubes are resting on the bottom one, and if I take that away, the others will sink down. So it is with the atmosphere; the air that is above is sustained by the air that is beneath, and when the air is pumped away from beneath them, the change occurs which you saw when I placed my hand on the air-pump, and which you saw in the case of the bladder, and which you shall see better here. I have tied over this jar a piece of sheet India-rubber, and I am now about to take away the air from the inside of the jar, and if you will watch the India-rubber, which acts as partition between the air below and the air above, you will see when I pump how the pressure shows itself. See where it is going to; I can actually put my hand into the jar; and yet this result is only caused by the great and powerful action of the air above. How beautifully it shows this curious circumstance!

Here is something that you can have a pull at when I have finished to-day. It is a little apparatus of two hollow brass hemispheres, closely fitted together, and having connected with it a pipe and a cock, through which we can exhaust the air from the inside, and though the two halves are so easily taken apart while the air is left within, yet you will see when we exhaust it by and by, no power of any two of you will be able to pull them apart. Every square inch of surface that is contained in the area of that vessel sustains fifteen pounds by weight, or nearly so, when the air is taken out; and you may try your strength presently in seeing whether you can overcome that pressure of the atmosphere.

Here is another very pretty thing—the boy's sucker, only refined by the philosopher. We young ones have a perfect right to take toys, and and make them into philosophy, inasmuch as now-a-days we are turning philosophy into toys. Here is a sucker, only it is made of India-rubber; if I clap it up on the table, you see at once it holds. Why does it hold? I can slip it about, but if I try to pull it up, it seems as if it would pull the table with it. I can easily make it slip about from place to place; but only when I bring it to the edge of the table can I get it off. It is only kept down by the pressure of the atmosphere above. Here is a couple of them; if you take these two and press them together, you will see how strong they stick. And, indeed, we may use them as they are proposed to be used, to stick against windows or against walls, where they will adhere for an evening, and serve to hang anything on that you want. I think, however, that you boys ought to have experiments that you can make at home; and so here is a very pretty experiment in illustration of the pressure of the atmosphere. Here is a tumbler of water; suppose I were to propose to you to turn that tumbler upside down, so that the water should not fall out, and yet not keep it in by my hand, but merely by using the pressure of the atmosphere; could you do that? Take a wine glass, either quite full or half full of water, and put a flat card on the top; turn it upside down, and then see what becomes of the card and of the water. The air cannot get in because the water, by its capillary attraction round the edge, keeps it out.

I think this will give you a strong notion of what you may call the materiality of the air, when I tell you that that box contains a pound of it, and this room more than a tun, and you will begin to think that air is something very serious. I will make another experiment to convince you of this positive resistance. There is that beautiful experiment of the pop gun, made so well and so easily, you know, out of a quill, or a tube, or anything of that kind; where we take a slice of potato, for instance, or an apple, and take the tube and cut out a pellet, as I have now done, and push it to one end. I have made that end tight; and now I take another piece and put it in; it will confine the air that is within the tube perfectly and completely for our purpose; and now I shall find it absolutely impossible, by any force of mine, to drive that little pellet close up to the other. It cannot be done; I may press the air to a certain amount, but if I go on pressing, long before it come to the second, the confined air will drive the front one out with a force something like that of gunpowder; for gunpowder is in part dependent upon the same action that you saw in this case.

Here is an experiment which I saw the other day, and was much pleased with, as I thought it would answer our purpose here. (I ought to have held my tongue for four or five minutes before I began this experiment, because I depend upon the strenth of my lungs for the success of it.) By the proper application of air, I expect to drive this egg out of one cup into the other by the force of my breath, but if I fail, it is in a good cause, and I do not promise success, because I have been talking more than I ought to do, to make the experiment succeed.

[The lecturer here tried the experiment, and succeeded in blowing the egg from one egg-cup to the other.]

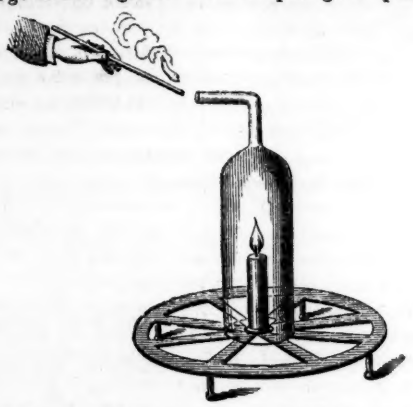
You see that the air which I blow goes downward between the egg and the cup, and makes a blast under the egg, and is thus able to lift a heavy thing—for a full egg is a very heavy thing for air to lift. If you want to make the experiment, you had better boil the egg quite hard first, and then you may very safely try to blow it from one cup to the others with a little care.

I think I have now kept you long enough upon this property of the weight of the air, but there is another thing I should like to mention. You saw the way in which, in this pop-gun, I was able to drive the second piece of potato half or two-thirds of an inch before the first piece started, by virtue of the elasticity of the air; just as I pressed into the copper bottle the particles of air by means of the pump. Now, this depends upon a wonderful property in the air, namely, its elasticity, and I should like to give you a good illustration of this. It is this: if I take anything that confines the air properly, as this membrane, it is able to contract and expand so as to give us a measure of the elasticity of the air, and to confine with a certain portion of air; and then, if we take the atmosphere off from the outside of it, just as in these cases we put the pressure on—if we take the pressure off, you will see how it will then go on expanding and expanding, larger and larger, until it will fill the whole of this bell jar, showing you that wonderful property of the air, its elasticity, its compressibility and expansibility, to an exceedingly large extent; and this is very essential for the purposes and services it performs in the economy of creation.

We will now turn to another most important part of our subject, remembering that we have examined

the candle in its burning, and have found that it gives rise to various products. We have the products, you know, of soot, of water, and of something else which you have not examined. We have collected the water, but have allowed the other things to go into the air. Let us now examine some of these other products.

Here is an experiment which, I think, will help you in part in this way. We will now put our candle there, and place over it a chimney, thus. I think my candle will go on burning, because the air passage is open at



the bottom and at the top. In the first place, you see the moisture coming—that you know about. It is water produced from the candle by the action of the air upon its hydrogen. But besides that, something is going out at the top; it is not moisture—it is not water—it is not condensible; and yet, after all, it has very singular properties. You will find that the air coming out of the top of our chimney is nearly sufficient to blow the light out I am holding to it, and if I put the light fairly opposed to the current, it will blow it quite out. You will say, that is as it should be, and I am supposing that you think it ought to do so, because the nitrogen does not support combustion, and ought to put the candle out, since the candle will not burn in nitrogen. But is there nothing else there than nitrogen? I must now anticipate—that is to say, I must use my own knowledge, to supply you with the means that we adopt for the purpose of ascertaining these things, and examining such gases as these. I will take an empty bottle—here is one—and if I hold it over this chimney, I shall get the combustion of the candle below, sending its results into the bottle above; and we shall soon find that this bottle contains, not merely an air that is bad as regards the combustion of a taper put into it, but having other properties.

Let me take a little quick-lime and pour some common water on to it—the commonest water will do. I will stir it a moment, then pour it upon a piece of filtering paper in a funnel, and we shall very quickly have a clear water proceeding to the bottle below, as I have here. I have plenty of this water in another bottle, but, nevertheless, I should like to use the lime water that was prepared before you, so that you may see what its uses are. If I take some of this beautiful clear lime water, and put that into this jar, which has collected the air from the candle, you will see a change coming about. Do you see that that water has got quite milky? Observe, that will not happen with air merely. Here is a bottle filled with air, and if I put a little lime water into it, neither the oxygen nor the nitrogen, nor anything else that is in that quantity of air, will make any change in the lime water—it remains clear and perfect, and no shaking of that quantity of lime water with that quantity of air in its common state will cause any change; but if I take this bottle with the lime water and hold it so as to get the general products of the candle in contact with it, in a very short time, you see, we shall have it milky—there is the chalk, consisting of the lime which we used in making the lime water, combined with something that came up from the candle—that other product which we are in search of, and which I want to tell you about to-day. This is a substance made visible to us by its action, which is not the action of the lime water itself, but it is something new to us from the candle. And then we find this white powder produced by the lime water and the vapor from the candle, appears to us very much like whiting or chalk, and when examined it does not prove to be exactly the same substance as whiting or chalk. So we are led, or have been led, to observe upon the various circumstances of this experiment, and to trace this production of chalk to its various causes to give us the true knowledge of the nature of this combustion of the candle—to find that this substance issuing from the candle is exactly the same as that substance which would issue from a retort if I were to put some chalk into it and make it red hot with a little moisture; you would then find that exactly the same substance would issue from it as from the candle.

But we have a better means of getting this substance, and in greater quantity so as to ascertain what its general characters are. We find this substance in very great abundance in a multitude of cases where you would least expect it. All limestones contain a great deal of this gas which issues from the candle, and which we call *carbonic acid*. All chalks, all shells, all corals, contain a great quantity of this curious air. We find it fixed in these stones, for which reason Dr. Black called it "fixed air"—finding in these fixed things like marble and chalk—he called it fixed air because it lost its quality of air, and assumed the condition of a solid body. We can easily get this air from marble. Here is a jar containing a little muriatic acid, and here is a taper which, if I put it to that jar, will show only the presence of common air. There is, you see, pure air down to the bottom; the jar is full of it. Here is a substance—marble, a very beautiful and superior marble—and if I put these pieces of marble into that jar, a great boiling apparently goes on. That, however, is not steam; it is a gas that is rising up, and if I now search the jar by a candle, I shall have exactly the same effect produced upon the taper as I had from the air which issued from the end of the chimney over the burning candle. It is exactly the same action, and caused by the very same substance that issued from the candle; and in this way we can get carbonic acid in great abundance—we have already nearly filled the jar. We also find that this gas is not merely contained in marble. Here is a vessel in which I have put some common whiting chalk, which has been washed in water, and deprived of its coarser particles, and so supplied to the plasterer as whiting. Here is a large jar containing this whiting and water, and I have here some sulphuric acid, which is the acid you might have to use if you were to make these experiments (only in using this acid with limestone, the body that is produced is an insoluble substance, whereas the muratic acid produces a soluble substance that does not much thicken the water). And you will seek out a reason why I take this kind of apparatus for the purpose of showing this experiment. I do it because you may repeat in a small way what I am about to do in a large one. You will have just the same kind of action, and I am evolving in this large jar carbonic acid exactly the same in its nature and properties as the gas which we obtained from the combustion of the candle in the atmosphere. And no matter how different the two methods by which we prepare this carbonic acid, you will see, when we get to the end of our subject, that it is all exactly the same, whether prepared in the one way or in the other.

We will now proceed to the next of our experiments with respect to this gas. What is its nature? Here is one of the vessels full, and we will try it as we have done so many other gasses—by combustion. You see it is not combustible, nor does it support combustion. Neither, as we know, does it dissolve much in water, because we collect it over water very easily. Then you know that it has an effect and becomes white in contact with lime water, and when it does become white in that way, it becomes one of the constituents to make carbonate of lime or limestone.

Now, the next thing is to show you that it does dissolve a little in water, and therefore that it is unlike oxygen and hydrogen in that respect. I have here an apparatus by which we can produce this solution. In the lower part of this apparatus is marble and acid, and in the upper part cold water. The valves are so arranged that the gas can get from one to the other. I will set it in action now, and you see the gas bubbling up through the water, as it has been doing all night long, and by this time we shall find that we have this substance dissolved in the water. If I take a glass and draw off some of the water, I find that it tastes a little acid to the mouth; it is impregnated with carbonic acid; and if I now apply a little lime water to it, that will give us a test of its presence. This water will make the lime water turbid and white, which is the carbonic acid test.

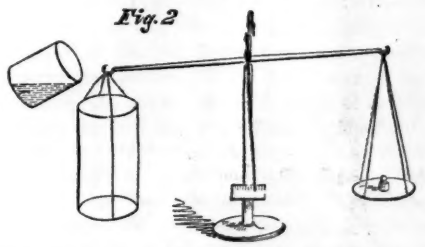
Then it is a very weighty gas; it is heavier than the atmosphere. I have put their respective weights at the lower part of this table, along with, for comparison, the weights of the other gases we have been examining:

	PINT.	CUBIC FOOT.
Hydrogen, ...	½ grs.	1-12 oz.
Oxygen, ...	11 9-10	1 1-3
Nitrogen, ...	10 4-10	1 1-6
Air, ...	10 7-10	1 1-5
Carbonic acid, . .	16 1-3	1 9-10

A pint of it weighs 16 1-3 grains, and a cubic foot weighs 1 9-10 ounces, almost two ounces. You can see by many experiments that this is a heavy gas. Suppose I take a glass containing nothing else but air, and this vessel containing the carbonic acid; and suppose I pour a little of this gas into that glass, I wonder whether any has gone in or not; I cannot tell by the appearance, but I can in this way [introduces the taper]. Yes, there it is, you see; and if I were to examine it by lime water, I should find it in the same way. I will take this little bucket, and put it down into the well of carbonic acid—indeed we too often have real wells of carbonic acid—and now, if there is any carbonic acid I must have got to it by this time, and it will be in this bucket, which we will examine with a taper. There it is, you see; it is full of carbonic acid.

I have another experiment by which I will show you its weight. I have here a jar suspended at one end of a balance—it is now equipoised, but when I pour this carbonic acid into the jar on the one side, which now contains air, you will see it sink down at once, because of the carbonic acid that I pour into it. And now I examine this jar with the lighted taper. I

Fig. 2



will find that the carbonic acid has fallen into it, and it no longer has any power of supporting combustion. If I blow a soap bubble, which, of course, will be filled with air, and let it fall into this jar of carbonic acid, it will float. But I shall, first of all, take one of these little baloons filled with air. I am not exactly sure where the carbonic acid is; we will just try the depth, and see whereabouts is its level. There, you see, we have this bladder floating on the carbonic acid, and if I evolve some more of the carbonic acid, you will see the bladder lifted up higher. There it goes; the jar is nearly full, and now I will see whether I can blow a soap bubble on that and float it in the same way. [The lecturer here blew a soap bubble, and allowed it to fall into the jar of carbonic acid, when it floated in it midway.] It is floating as the balloon floated, by virtue of the greater weight of the carbonic acid than of the air. And now, having so far given you the history of the carbonic acid, as to its sources in the candle, as to its physical properties and weight, when we next meet I shall show you of what it is composed, and where it gets its elements from.

COAL IN FRANCE.—It appears from a document issued by the "Committee of Coal-Pit Owners," that the extraction of coal in France in 1857 was 7,900,000 tons, from 62 coal-fields. Of that quantity six fields yielded not less than 6,485,200 tons—viz., that of the Loire, 2,242,600 tons; the Nord and Pas de Calais, 1,960,600 tons; Gard, 754,000 tons; Blanzy and Creuzot, 586,000 tons; the Allier, 484,500; and the Averyon the rest. From 11 other districts quantities varying from 40 000 to 200,000 tons were extracted, and the quantity obtained from the other 45 was, consequently, but small. In 1852 the total extraction was only 4,900,000 tons, so that in the space of five years it has increased by 3,000,000 tons.

WATER-WORKS OF AMERICA.

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From sale of ferules, wharfage, &c	2,957.91
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Expenditures for the year	169,006.84
Balance remaining in the Treasury, December 31, 1860.	$28,922.88

Of the $169,000 expenditures during the year 1860, about $60,000 was expended in lines of pipe, and the balance, $109,000, in the payment of interest on $875,000 water-works bonds, and the current expenses of the works.

A further reduction of nearly twenty-five per cent. was made on the first day of July last, on bills for water rents; yet with all this large reduction the receipts have fallen short of 1859 only some $6,758. This is partly the result of the largely increased demand for water throughout the city, and partly from the system adopted in equalizing the burthens of the department, by charging all persons at a uniform rate as near as can be ascertained by estimate or the test of the water meter. A further reduction is in contemplation, to take place at an early day. It is the intention of the trustees to reduce the collection of water rents by an amount equal to the sum collected by assessment on the front foot of the line of the pipe, and to supply the people with water at the lowest possible rates.

When it is remembered that a reduction of water rates, amounting as was supposed to an average of 22 per cent. on all families, and from 30 cents per 1,000 gallons to 17½ cents per 1,000, by quantities, was made, taking effect January 1, 1860; and that a still farther reduction, equal to about 11 per cent. on families, and from the rate of 17½ cents per 1,000 gallons by quantities, to 13 cents; this latter tariff taking effect July 1, 1860, and continuing to the end of the year; or an average reduction for the year, equal to 33 per cent. to small consumers, and 14¾ cents per 1,000 gallons by quantity, or, as was estimated, a reduction equal to 40 per cent. on last year's prices; and that notwithstanding this, the actual deficiency only amounts to a little more than 3¾ per cent. of the receipts of that year; this result is as unexpected as it is gratifying, and it may be well to glance for a moment at some of the principal causes which have produced it.

The old tariff of rates afforded water to large consumers at 10 cents per 1,000 gallons, to smaller ones at 25 cents per 1,000, and to the smallest at 30 cents per 1,000. This great difference in price, gave to large consumers undue advantage in point of price, and in addition, the amount consumed was entirely unknown, and was in fact, in almost all cases, much more than was paid for, even at this low price; the result was, that a large proportion of the water was furnished at a price much below its actual cost to the works, and large consumers reaped an advantage, which was made up to the works by overcharging small consumers.

The application of water meters, and the institution of extensive experiments, revealed the true state of the case, resulting in largely increasing the *amount* paid by large consumers, though the *rates* were reduced to all with a very few exceptions.

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Proceeds of special tax, probably..... 40,000.00
Balance on hand January 1st, 1861..... 28,932.88

Total recipts for 1861.....$233,932.88

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Interest and exchange on bonds	$52,600	
Running and other expenses of the works	30,000	
Extension of street mains	32,050	
New engine and pumps	50,000	
Repairs to street service	1,000	
Repairs at pump house	1,000	
Bills payable	20,000	
Salaries of officers	7,350	
Commissions on collections	4,250	
		198,250.00
Surplus		$35,682.88

The deposits in the pipes have become so indurated or hardened, as to resist the action of the water in flushing, and only a small amount can be thrown off by this means.

These deposits in the lower portions of the city, consist almost entirely of the sediment from the water, combined with the oxide of iron from the pipes, the two together forming a compact, tenacious mass; there are also tubercles formed in these, and indeed all the pipes; of conical form, having bases of from one-eighth of an inch to an inch in diameter, and a height varying from one-quarter of an inch to one inch; these adhere to the inner surface of the pipes all round, and extend toward the centre from all points. In addition to this, many pipes on the upper levels, contain great numbers of small snail-shaped shell-fish, (*Melania Cornica, Melania Semicarinata, Melania Sagii, Melania Sigii*, banded variety, and *Melania Canaliculata*, five species,) these adhere to the sediment, tubercles, and inside of the pipes with such tenacity, that they can not be flushed out in any considerable numbers while living, but the dead shells may by this process be discharged. These fish appear to propogate themselves in the pipes, and from their great numbers, dead and alive, contribute largely to the filling up of pipes. They have not been found in any pipes having a head of water greater than sixty feet, from which it is inferred that they cannot live under a pressure greater than is due to that head.

There are several localities where the deposits are so great that the pipes must soon be removed. It is recommended that all pipes hereafter laid, be coated with some suitable material, so applied as to prevent oxidation of the pipe, especially the interior surface, as is now extensively, indeed almost universally, practiced in this country and Europe. Among the advantages to be gained by this process, may be named,—the greater discharge through a given pipe—preventing the formation of tubercles in the pipe—preventing the induration or hardening of the deposits in the pipes, depriving them of the oxide of iron—affording a smooth surface, from which the sediment may be entirely removed by flushing—and finally, by preventing the deterioration of the pipes by oxidation.

PIPE LAID IN 1860.

The total amount of pipe laid during the year has been 27,933¼ feet, or 5,291 miles; and 350 feet of four inch pipe has been taken up. Deducting this from the amount laid, and the actual increase of pipe in the city is 27,583¼ feet, or 5,225 miles.

The pipe laid consisted of the following:

7,681	feet	20	inch,	equal to 1,455	miles.
839	do.	10	do.	do. 158	do.
63	do.	8	do.	do. 12	do.
19,350¼	do.	4	do.	do. 3,665	do.
240	do.	4	do.	do. 45	do.
28,173¼	feet.			5,336	miles.

HYDRANTS, &c.

The Water Works and its patrons experience much trouble and inconvenience, and suffer great loss, from defective hydrants and stops, and the boxes of the latter. There are probably few departments in mechanism where so little taste and mechanical skill has been displayed, and where so little that is really valuable has been accomplished, as in this very important branch of business. With very rare exceptions, a hydrant is an uncouth post or box, externally and internally so poorly planned, and worse put together, that a few weeks or months of use puts it out of order, and then the owner has the vexation of seeing his neat pavement torn up, his grass-plat destroyed, and his carpets well tracked with mud; and in addition a heavy bill to pay. Nor is the case any better when the stop-box is examined; it is, if possible, a worse contrived and constructed affair than the other, and has afforded many water renters good reason, as they suppose, to find fault with the Water Works, or rather with those who manage them. There is great room for invention, in plan and improvement, in material and workmanship in this department. There are encouraging signs of improvement among some of our plumbers, who now make hydrants that can be taken up without disturbing the pavement.

Water-closets and urinals are not much better than the hydrants, and are among the greatest sources of trouble and loss to the Works, and annoyance and expense to their owners.

WATER METERS.

There are in the city thirty-six water meters, as follows:

3	3 inch	Worthington meters,	New York.		
2	2 "	"	"	"	"
1	⅝ "	"	"	"	"
3	1 "	Kenedy	"	Kilmarnock,	Scotland.
3	⅝ "	"	"	"	"
1	3 "	Phillips'	"	Cincinnati,	new style.
1	2 "	"	"	"	old "
7	1½ "	"	"	"	new "
7	1¼ "	"	"	"	old "
5	1 "	"	"	"	new "
3	¾ "	"	"	"	new "

Of the above the Water Works own:

2	3 inch	Worthington,	
2	2 "	"	
3	1 "	Kenedy,	
1	2 "	Phillips',	
5	1¼ "	"	

and the residue belong to individuals and corporations. All the above are good meters, and work well when well made; the Kenedy and Phillips' (old style,) having portions of their works outside or exposed, and having piston rods extending through their heads, are liable to two objections—they may be tampered with by dishonest persons, and are troublesome to keep in order, especially when the water is muddy—the Worthington and Phillips' new meters, however, are not liable to either of the above objections, all the working parts being metal, without packing or stuffing boxes, (except for the small register spindle,) and being inside the meter, they can not be tampered with; and working in the water do not require lubrication; and can, with very little attention, be kept perfectly dry, and are withal very durable, reliable, and accurate.

Other meters of cheap construction have been presented for trial but have not been found to work satisfactorily.

NEW ENGINE, RESERVOIR AND SUPPLY FOR HIGHER LANDS.

When the new engine is completed the works will possess adquate pumping capacity for all demands for the present, and far in the future; and nothing farther will remain to be done but to furnish adequate reservoir capacity, by which means the public will be furnished with *pure* water.

The importance, and indeed the necessity of a supply of water to the higher levels of the city, is becoming more and more apparent daily; to afford this, will require at least two additional reservoirs. The highest point in the city above low water in the Ohio is 466 feet—the present reservoir is 178 feet above low water. If another was constructed 178 feet above the present one, its surface would still be 110 feet below the highest ground on Mount Auburn. Whenever it becomes necessary to supply reservoirs at either of these elevations, engines must be placed at the present reservoir, or some other of the same height, and the water taken from that raised to the next, and again from this, by another engine to the highest. Two distinct and independent systems of pipes for distribution must also be laid, having no connection with the present system, or with each other; for the reason, that such a head would produce a pressure far beyond the strength of the pipes now in use, and would in addition force the water back through the pipes into the lower reservoir.

It is evident that either of these projects would cost a considerable sum; and however desirable it may be to afford water to all persons in the city at the earliest

possible time, it would be great injustice to the water renters and those who have already furnished themselves at so large an expense, and who do now and always have furnished the city and its fire department water gratis, to compel them to afford water facilities to those residing above the present watered district of the city in addition.

WATER WORKS DEBT AND THEIR PRESENT VALUE.

The Water Works debt is $875,000, the annual interest and exchange on which is almost $53,000.

In 1855 the value of the Cincinnati Water Works was estimated at $2,000,000, The average annual expenditure for extension account alone, since that time, has been at least $50,000, or an aggregate of $250,000; and adding this to the estimates, the present value is $2,250,000, or a clear profit, after paying the entire debt of $1,375,000.

MAPS AND PLATS AND VERIFICATION OF PERMITS.

The map and plat books commenced last year are almost complete, and a thorough and complete verification of all permits issued, up to this time, has been made and recorded in suitable books. These maps are upon a large scale, and embrace the entire watered portions of the city, showing all the mains in the city, the several sizes of pipes being represented by distinctive lines; all crosses, T's, stops, fire-hydrants, fire-cisterns, and the length of all distributing mains, from point to point, from actual measurement, are clearly and distinctly shown. These are mounted upon a new plan, completely cased, and so arranged that any portion of the mains of the city can be brought into view at any moment; while the maps can be readily removed from the cases, and additions or alterations made as they become necessary, and the map returned to its case. The plat books show the exact location of every ferrule and pipe, stop-box, plug and hydrant in the city, by scale, as well as by actual measurement, or from the plumber's returns, (most of which have been verified by actual measurement.)

LEAKAGE AND WASTE.

Careful observation and measurements made at the reservoir by the engineer during the past year, has demonstrated, that an amount of leakage equal to 1,118,080 gallons takes place in twenty-four hours, or about twenty-two per cent. of all the water delivered to the reservoir. This result was obtained by noting the water between the hours of 12 o'clock, midnight, and 3 o'clock, morning, when it is assumed there is very little water actually used; the least fall, however, was taken, and from this minimum quantity twenty-five per cent. was deducted for actual or legitimate use.

The whole leakage in the street mains, valves, and all other portions of the works, properly belonging to them, does not amount to two per cent. of the amount delivered to the reservoirs, and therefore about twenty per cent. of the whole supply may be charged to leakage and other waste, in and through the small sluice pipe, their valves, hydrants, water-closets, urinals, &c.

Taking into account the fact that there are probably 18,000 outflows in the city, and that upon an average probably one-third of these are constantly leaking, more or less; that a very small leak, that would scarcely attract attention, will waste from 100 to 400 gallons in twenty-four hours, and that many leaks, in water-closets, urinals, &c., amounting from 400 to 20,000 gallons in twenty-four hours. It becomes apparent that the result above obtained is probably below the truth, for 6,000 leaks, discharging upon an average 200 gallons each in twenty-four hours, will waste 1,200,000 gallons of water daily.

The total population of the western district of Cincinnati, by the late census, is 160,000. Assuming the average daily delivery as 5,000,000 gallons, gives a daily consumption of 31.25 gallons for each inhabitant.

Deducting the amount of waste, say twenty per cent., making the aggregate daily supply 4,000,000 gallons, and the aggregate consumption for each inhabitant becomes twenty-five gallons.

The actual population of the city being 171,000, and the aggregate daily consumption being 5,000,000 gallons, the consumption for each inhabitant is 29.41 gallons daily.

The city of Boston has a population of 177,000, and consumes a daily average of 17,700,000 gallons, or 97 gallons for each inhabitant; nearly *three and one-third times* the rate in Cincinnati.

RESERVOIRS.

At the time of cleaning the reservoirs, during the past spring, a careful and thorough examination was had of their internal appearance and general condition, resulting in the conviction of their perfect reliability for future service.

Two new strainers will be required to be had in readiness for the distributing reservoir at the approaching time of cleaning out, as the old ones have become too much rotted and worn to be reliable for another year.

The expense attending this division of the pumping service for the past year amounts in the aggregate to $138.66-100, as follows: For cleaning reservoirs, $112.91-100, and for repairs of fencing, blown down by the tornado of May 21st, $25.75-100.

RELATIVE DEMAND FOR WATER, AND THE CAPACITY OF SUPPLY FOR SIXTEEN YEARS.

Years.	Peservoirs capacity in cubic feet.	Pumps capacity of supply for 24 hours run, in cubic feet.	Consumption during 24 hours, taken from the excessive demand of a day selected in each year, in cubic feet.
1845	227,256	597,077	420,507
1846	227,256	440,000	181,952
1847	227,256	1,030,588	372,033
1848	227,256	1,030,588	516,764
1849	227,256	1,030,588	514,714
1850	386,299	1,030,588	483,942
1851	386,299	1,538,208	516,047
1852	793,825	1,098,208	532,395
1853	793,825	1,611,607	543,009
1854	793,825	1,611,607	584,943
1855	793,825	1,611,607	610,018
1856	793,825	1,611,607	665,953
1857	691,282	1,611,607	701,889
1858	691,282	1,611,607	749,479
1859	691,282	1,611,607	947,525
1860	691,282	1,611,607	1,074,915

TOTAL GALLONS DELIVERED TO RESERVOIRS EACH MONTH.

	1859.	1860.
January	119,708,386	125,461,008
February	89,455,383	121,786,704
March	128,921,931	131,721,388
April	123,696,140	122,943,982
May	140,579,607	149,179,558
June	143,993,474	163,370,723
July	181,212,093	164,020,891
August	176,249,870	183,789,257
September	156,789,948	185,340,832
October	153,420,999	183,540,387
November	138,704,924	152,457,032
December	133,046,171	141,198,912

DAILY AVERAGE GALLONS FOR THE MONTH.

	1859.	1860.
January	3,861,560	4,047,129
February	3,194,834	4,199,541
March	4,158,771	4,249,077
April	4,123,204	4,098,132
May	4,534,826	4,812,243
June	4,799,782	5,445,690
July	5,845,550	5,290,996
August	5,685,479	5,928,040
September	5,226,263	6,178,027
October	4,949,064	5,920,657
November	4,623,497	5,081,901
December	4,291,811	4,554,813

Total gallons delivered during 1859	1,685,777,041
" " " " 1860	1,824,815,008
Increase of 1860	139,037,967
Average daily delivery for the year 1859.	4,618,567
" " " 1860.	4,999,493
Increase daily average	380,926
Maximum supply of a day of the year 1859.	7,087,979
" " " 1860.	8,040,922
Maximum time of 3 engines, 1859, 44 hours.	
" " " 1860, 49 "	10 minutes.

OFFICERS OF THE

CINCINNATI, O., WATER WORKS,

FOR 1861.

Board of Trustees,
GEORGE KECK, President.
B. T. STONE,
CHAS. RULE.

Superintendent,
R. C. PHILIPS.

Engineer,
GEORGE SHIELD.

Secretary,
J. M. HANSON.

Assistant-Secretary,
JOHN J. HOOKER.

Hydrant Surveyor,
T. L. PROWS.

Collectors,
J. P. WILLIAMS, Eastern District.
W. RENAU, Middle District.
JAMES BENSE, Western District.

WATER-WORKS OF PHILADELPHIA AND NEW YORK.—The water-works of Philadelphia now supply about 65,000 water renters, at $2.50 each and upwards, according to the number of openings in the pipes. The entire receipts into the department for water and pipe amount to about $550,000 annually, giving a net income to the city of nearly $200,000. In New York there are but 50,000 water takers, and they have to pay, exclusive of water pipe, which is paid for out of a loan, $750,000 annually, the rents being $10 and upwards. With this large revenue there is every year a large deficiency. Though the works of Philadelphia are very complete, the rapid spread of the city, and the continual erection of new buildings in the outer wards, have tested their capacity to the utmost in warm weather to supply the increased demand. Councils, in examining into the subject, concluded to enlarge the works at Fairmount by the erection of a new millhouse of sufficient capacity to contain three of the largest sized turbine wheels, by which the power at Fairmount would be doubled, and for years prevent any scarcity in the supply of water. The work was commenced, and the foundations for the buildings completed; but in doing this the appropriation made for the work was exhausted, and councils have just passed a loan bill of $42,500 to finish the job.

DOBBS FERRY, N. Y.—Lighted up January 1st, 1861. Consumers pledged to take gas—135—amongst whom are two large manufactories, one of sugar and the other lager, each of which will have about three hundred burners, it is said. Sugar-house just finished—not in full operation yet. When gas-works are complete will have as consumers, one sugar-house, one pickling (vegetable) establishment, one lager beer brewery, fifty-five ordinary village dwellings, stores, taverns, &c., and about seventy-five villas, castles, and other descriptions of country residences of merchants, lawyers, &c. The pipe now connects Hastings and Dobbs Ferry—will be extended the following month nearly to Irvington. On this line are the princely residences of merchants Minturn, Strange, Foote, Paton, Cottenet, Trask, Mount, McNamee, and others, who are to be the principal consumers of gas. When this line of pipe is laid, and a few miles of interregnum filled here and there, there will be a continual line of gas-pipe from the Battery, New York city, to and above Sing Sing, say thirty-five miles, along the old Albany post-road named Broadway, in all the villages, and consequently (in course) ditto in the village of New York. Broadway is now 165 miles in length, reaching from the Battery in this city to Troy, N. Y. To entirely finish the various contracts for mains, services, &c., will occupy say to July 4th of the present year. John M. Long is superintendent of the gas-works. W. L. Schoener & Co., engineers and contractors.

IMPROVEMENT IN STREET LANTERNS. — Degrand's lenses are attracting a great deal of attention in Paris. They produce the same effect on a much smaller scale, and at a comparatively trifling cost, as the famous lenses of Fresnal, which are generally used in light-houses throughout the world. In ordinary street lamps, a large portion of the light is sent up overhead into the atmosphere, where it does no good, and it is very plain that if this light could be reflected or bent down into a horizontal sheet, it would be utilized, and add much to the light of the streets. M. Degrand has found that thin lenses answer the purpose, and that these may be made cheaply by softening the glass by heat and pressing it in a mould. Careful experiments have shown that by the interposition of these lenses, the light of an ordinary lamp is increased more than fivefold—from 1 to 5.49.

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Repairs to street service	1,000	
Repairs at pump house	1,000	
Bills payable	20,000	
Salaries of officers	7,350	
Commissions on collections	4,250	
		198,250.00
Surplus		$35,682.88

The deposits in the pipes have become so indurated or hardened, as to resist the action of the water in flushing, and only a small amount can be thrown off by this means.

These deposits in the lower portions of the city, consist almost entirely of the sediment from the water, combined with the oxide of iron from the pipes, the two together forming a compact, tenacious mass; there are also tubercles formed in these, and indeed all the pipes; of conical form, having bases of from one-eighth of an inch to an inch in diameter, and a height varying from one-quarter of an inch to one inch; these adhere to the inner surface of the pipes all round, and extend toward the centre from all points. In addition to this, many pipes on the upper levels, contain great numbers of small snail-shaped shell-fish, (*Melania Cornica, Melania Semicarinata, Melania Sagii, Melania Sigii*, banded variety, and *Melania Canaliculata*, five species,) these adhere to the sediment, tubercles, and inside of the pipes with such tenacity, that they can not be flushed out in any considerable numbers while living, but the dead shells may by this process be discharged. These fish appear to propogate themselves in the pipes, and from their great numbers, dead and alive, contribute largely to the filling up of pipes. They have not been found in any pipes having a head of water greater than sixty feet, from which it is inferred that they cannot live under a pressure greater than is due to that head.

There are several localities where the deposits are so great that the pipes must soon be removed. It is recommended that all pipes hereafter laid, be coated with some suitable material, so applied as to prevent oxidation of the pipe, especially the interior surface, as is now extensively, indeed almost universally, practiced in this country and Europe. Among the advantages to be gained by this process, may be named,—the greater discharge through a given pipe—preventing the formation of tubercles in the pipe—preventing the induration or hardening of the deposits in the pipes, depriving them of the oxide of iron—affording a smooth surface, from which the sediment may be entirely removed by flushing—and finally, by preventing the deterioration of the pipes by oxidation.

PIPE LAID IN 1860.

The total amount of pipe laid during the year has been 27,933½ feet, or 5,291 miles; and 350 feet of four inch pipe has been taken up. Deducting this from the amount laid, and the actual increase of pipe in the city is 27,583½ feet, or 5,225 miles.

The pipe laid consisted of the following:

7,681	feet	20 inch,	equal to	1,455	miles.
839	do.	10 do.	do.	158	do.
63	do.	8 do.	do.	12	do.
19,350½	do.	4 do.	do.	3,665	do.
240	do.	4 do.	do.	45	do.
28,173½	feet.			5,336	miles.

HYDRANTS, &c.

The Water Works and its patrons experience much trouble and inconvenience, and suffer great loss, from defective hydrants and stops, and the boxes of the latter. There are probably few departments in mechanism where so little taste and mechanical skill has been displayed, and where so little that is really valuable has been accomplished, as in this very important branch of business. With very rare exceptions, a hydrant is an uncouth post or box, externally and internally so poorly planned, and worse put together, that a few weeks or months of use puts it out of order, and then the owner has the vexation of seeing his neat pavement torn up, his grass-plat destroyed, and his carpets well tracked with mud; and in addition a heavy bill to pay. Nor is the case any better when the stop-box is examined; it is, if possible, a worse contrived and constructed affair than the other, and has afforded many water renters good reason, as they suppose, to find fault with the Water Works, or rather with those who manage them. There is great room for invention, in plan and improvement, in material and workmanship in this department. There are encouraging signs of improvement among some of our plumbers, who now make hydrants that can be taken up without disturbing the pavement.

Water-closets and urinals are not much better than the hydrants, and are among the greatest sources of trouble and loss to the Works, and annoyance and expense to their owners.

WATER METERS.

There are in the city thirty-six water meters, as follows:

3	3	inch	Worthington meters,	New York.	
2	2	"	"	"	"
1	⅝	"	"	"	"
3	1	"	Kenedy	"	Kilmarnock, Scotland.
3	⅝	"	"	"	"
1	3	"	Phillips'	"	Cincinnati, new style.
1	2	"	"	"	" old "
7	1½	"	"	"	" new "
7	1¼	"	"	"	" old "
5	1	"	"	"	" new "
3	¾	"	"	"	" new "

Of the above the Water Works own:

2	3	inch	Worthington,
2	2	"	"
3	1	"	Kenedy,
1	2	"	Phillips',
5	1¼	"	"

and the residue belong to individuals and corporations. All the above are good meters, and work well when well made; the Kenedy and Phillips' (old style,) having portions of their works outside or exposed, and having piston rods extending through their heads, are liable to two objections—they may be tampered with by dishonest persons, and are troublesome to keep in order, especially when the water is muddy—the Worthington and Phillips' new meters, however, are not liable to either of the above objections, all the working parts being metal, without packing or stuffing boxes, (except for the small register spindle,) and being inside the meter, they can not be tampered with; and working in the water do not require lubrication; and can, with very little attention, be kept perfectly dry, and are withal very durable, reliable, and accurate.

Other meters of cheap construction have been presented for trial but have not been found to work satisfactorily.

NEW ENGINE, RESERVOIR AND SUPPLY FOR HIGHER LANDS.

When the new engine is completed the works will possess adquate pumping capacity for all demands for the present, and far in the future; and nothing farther will remain to be done but to furnish adequate reservoir capacity, by which means the public will be furnished with *pure* water.

The importance, and indeed the necessity of a supply of water to the higher levels of the city, is becoming more and more apparent daily; to afford this, will require at least two additional reservoirs. The highest point in the city above low water in the Ohio is 466 feet—the present reservoir is 178 feet above low water. If another was constructed 178 feet above the present one, its surface would still be 110 feet below the highest ground on Mount Auburn. Whenever it becomes necessary to supply reservoirs at either of these elevations, engines must be placed at the present reservoir, or some other of the same height, and the water taken from that raised to the next, and again from this, by another engine to the highest. Two distinct and independent systems of pipes for distribution must also be laid, having no connection with the present system, or with each other; for the reason, that such a head would produce a pressure far beyond the strength of the pipes now in use, and would in addition force the water back through the pipes into the lower reservoir.

It is evident that either of these projects would cost a considerable sum; and however desirable it may be to afford water to all persons in the city at the earliest

possible time, it would be great injustice to the water renters and those who have already furnished themselves at so large an expense, and who do now and always have furnished the city and its fire department water gratis, to compel them to afford water facilities to those residing above the present watered district of the city in addition.

WATER WORKS DEBT AND THEIR PRESENT VALUE.

The Water Works debt is $875,000, the annual interest and exchange on which is almost $53,000.

In 1855 the value of the Cincinnati Water Works was estimated at $2,000,000, The average annual expenditure for extension account alone, since that time, has been at least $50,000, or an aggregate of $250,000; and adding this to the estimates, the present value is $2,250,000, or a clear profit, after paying the entire debt of $1,375,000.

MAPS AND PLATS AND VERIFICATION OF PERMITS.

The map and plat books commenced last year are almost complete, and a thorough and complete verification of all permits issued, up to this time, has been made and recorded in suitable books. These maps are upon a large scale, and embrace the entire watered portions of the city, showing all the mains in the city, the several sizes of pipes being represented by distinctive lines; all crosses, T's, stops, fire-hydrants, fire-cisterns, and the length of all distributing mains, from point to point, from actual measurement, are clearly and distinctly shown. These are mounted upon a new plan, completely cased, and so arranged that any portion of the mains of the city can be brought into view at any moment; while the maps can be readily removed from the cases, and additions or alterations made as they become necessary, and the map returned to its case. The plat books show the exact location of every ferrule and pipe, stop-box, plug and hydrant in the city, by scale, as well as by actual measurement, or from the plumber's returns, (most of which have been verified by actual measurement.)

LEAKAGE AND WASTE.

Careful observation and measurements made at the reservoir by the engineer during the past year, has demonstrated, that an amount of leakage equal to 1,118,080 gallons takes place in twenty-four hours, or about twenty-two per cent. of all the water delivered to the reservoir. This result was obtained by noting the water between the hours of 12 o'clock, midnight, and 3 o'clock, morning, when it is assumed there is very little water actually used; the least fall, however, was taken, and from this minimum quantity twenty-five per cent. was deducted for actual or legitimate use.

The whole leakage in the street mains, valves, and all other portions of the works, properly belonging to them, does not amount to two per cent. of the amount delivered to the reservoirs, and therefore about twenty per cent. of the whole supply may be charged to leakage and other waste, in and through the small sluice pipe, their valves, hydrants, water-closets, urinals, &c.

Taking into account the fact that there are probably 18,000 outflows in the city, and that upon an average probably one-third of these are constantly leaking, more or less; that a very small leak, that would scarcely attract attention, will waste from 100 to 400 gallons in twenty-four hours, and that many leaks, in water-closets, urinals, &c., amounting from 400 to 20,000 gallons in twenty-four hours. It becomes apparent that the result above obtained is probably below the truth, for 6,000 leaks, discharging upon an average 200 gallons each in twenty-four hours, will waste 1,200,000 gallons of water daily.

The total population of the western district of Cincinnati, by the late census, is 160,000. Assuming the average daily delivery as 5,000,000 gallons, gives a daily consumption of 31.25 gallons for each inhabitant.

Deducting the amount of waste, say twenty per cent., making the aggregate daily supply 4,000,000 gallons, and the aggregate consumption for each inhabitant becomes twenty-five gallons.

The actual population of the city being 171,000, and the aggregate daily consumption being 5,000,000 gallons, the consumption for each inhabitant is 29.41 gallons daily.

The city of Boston has a population of 177,000, and consumes a daily average of 17,700,000 gallons, or 97 gallons for each inhabitant; nearly *three and one-third times* the rate in Cincinnati.

RESERVOIRS.

At the time of cleaning the reservoirs, during the past spring, a careful and thorough examination was had of their internal appearance and general condition, resulting in the conviction of their perfect reliability for future service.

Two new strainers will be required to be had in readiness for the distributing reservoir at the approaching time of cleaning out, as the old ones have become too much rotted and worn to be reliable for another year.

The expense attending this division of the pumping service for the past year amounts in the aggregate to $138.66-100, as follows: For cleaning reservoirs, $112.91-100, and for ropairs of fencing, blown down by the tornado of May 21st, $25.75-100.

RELATIVE DEMAND FOR WATER, AND THE CAPACITY OF SUPPLY FOR SIXTEEN YEARS.

Years.	Reservoirs capacity in cubic feet.	Pumps capacity of supply for 24 hours run, in cubic feet.	Consumption during 24 hours, taken from the excavation demand of a day selected in each year, in cubic feet.
1845	227,256	597,077	420,507
1846	227,256	440,000	181,952
1847	227,256	1,030,588	372,033
1848	227,256	1,030,588	516,764
1849	227,256	1,030,588	514,714
1850	386,299	1,030,588	483,942
1851	386,299	1,538,208	516,047
1852	793,825	1,098,208	532,395
1853	793,825	1,611,607	543,009
1854	793,825	1,611,607	584,943
1855	793,825	1,611,607	610,018
1856	793,825	1,611,607	665,953
1857	691,282	1,611,607	701,889
1858	691,282	1,611,607	749,479
1859	691,282	1,611,607	947,525
1860	691,282	1,611,607	1,074,915

TOTAL GALLONS DELIVERED TO RESERVOIRS EACH MONTH.

	1859.	1860.
January	119,708,386	125,461,008
February	89,455,363	121,786,704
March	128,921,931	131,721,388
April	123,696,140	122,943,982
May	140,579,607	149,179,558
June	143,993,474	163,370,723
July	181,212,093	164,020,891
August	176,249,870	183,789,257
September	156,789,948	185,340,832
October	153,420,999	183,540,387
November	138,704,924	152,457,032
December	133,046,171	141,198,912

DAILY AVERAGE GALLONS FOR THE MONTH.

	1859.	1860.
January	3,861,560	4,047,129
February	3,194,834	4,199,541
March	4,158,771	4,249,077
April	4,123,204	4,098,132
May	4,534,826	4,812,243
June	4,799,782	5,445,690
July	5,845,550	5,290,996
August	5,685,479	5,928,040
September	5,226,263	6,178,027
October	4,949,064	5,920,657
November	4,623,497	5,081,901
December	4,291,811	4,554,813

Total gallons delivered during 1859	1,685,777,041
" " " " 1860	1,824,815,008
Increase of 1860	139,037,967
Average daily delivery for the year 1859.	4,618,567
" " " 1860.	4,999,493
Increase daily average	380,926
Maximum supply of a day of the year 1859.	7,087,979
" " " 1860.	8,040,922
Maximum time of 3 engines, 1859, 44 hours.	
" " " 1860, 49 " 10 minutes.	

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FOR 1861.

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WATER-WORKS OF PHILADELPHIA AND NEW YORK.—The water-works of Philadelphia now supply about 65,000 water renters, at $2.50 each and upwards, according to the number of openings in the pipes. The entire receipts into the department for water and pipe amount to about $550,000 annually, giving a net income to the city of nearly $200,000. In New York there are but 50,000 water takers, and they have to pay, exclusive of water pipe, which is paid for out of a loan, $750,000 annually, the rents being $10 and upwards. With this large revenue there is every year a large deficiency. Though the works of Philadelphia are very complete, the rapid spread of the city, and the continual erection of new buildings in the outer wards, have tested their capacity to the utmost in warm weather to supply the increased demand. Councils, in examining into the subject, concluded to enlarge the works at Fairmount by the erection of a new millhouse of sufficient capacity to contain three of the largest sized turbine wheels, by which the power at Fairmount would be doubled, and for years prevent any scarcity in the supply of water. The work was commenced, and the foundations for the buildings completed; but in doing this the appropriation made for the work was exhausted, and councils have just passed a loan bill of $42,500 to finish the job.

DOBBS FERRY, N. Y.—Lighted up January 1st, 1861. Consumers pledged to take gas—135—amongst whom are two large manufactories, one of sugar and the other lager, each of which will have about three hundred burners, it is said. Sugar-house just finished—not in full operation yet. When gas-works are complete will have as consumers, one sugar-house, one pickling (vegetable) establishment, one lager beer brewery, fifty-five ordinary village dwellings, stores, taverns, &c., and about seventy-five villas, castles, and other descriptions of country residences of merchants, lawyers, &c. The pipe now connects Hastings and Dobbs Ferry—will be extended the following month nearly to Irvington. On this line are the princely residences of merchants Minturn, Strange, Foote, Paton, Cottenet, Trask, Mount, McNamee, and others, who are to be the principal consumers of gas. When this line of pipe is laid, and a few miles of interregnum filled here and there, there will be a continual line of gas-pipe from the Battery, New York city, to and above Sing Sing, say thirty-five miles, along the old Albany post-road named Broadway, in all the villages, and consequently (in course) ditto in the village of New York. Broadway is now 165 miles in length, reaching from the Battery in this city to Troy, N. Y. To entirely finish the various contracts for mains, services, &c., will occupy say to July 4th of the present year. John M. Long is superintendent of the gas-works. W. L. Schoener & Co., engineers and contractors.

IMPROVEMENT IN STREET LANTERNS. — Degrand's lenses are attracting a great deal of attention in Paris. They produce the same effect on a much smaller scale, and at a comparatively trifling cost, as the famous lenses of Fresnal, which are generally used in lighthouses throughout the world. In ordinary street lamps, a large portion of the light is sent up overhead into the atmosphere, where it does no good, and it is very plain that if this light could be reflected or bent down into a horizontal sheet, it would be utilized, and add much to the light of the streets. M. Degrand has found that thin lenses answer the purpose, and that these may be made cheaply by softening the glass by heat and pressing it in a mould. Careful experiments have shown that by the interposition of these lenses, the light of an ordinary lamp is increased more than fivefold—from 1 to 5.49.

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PROPRIETOR, JOHN B. MURRAY. } { EDITOR, C. ELTON BUCK.

WEDNESDAY, MAY 15, 1861.

On page 311 of this volume we published an article from a Philadelphia paper, commenting on a suit brought by the City Gas Company against a consumer for non-payment of a quarterly gas bill, which exceeded the average bills of the same party for the same period about fourteen hundred per cent. The suit was decided against the gas company,—the jury awarding them only the average amount of former bills, and saddling them with the costs. The sole argument adduced by the company was, that as the meter indicated the amount for which the bill was rendered, there could be no disputing its accuracy, and they contended that under these circumstances the full amount registered must be paid for. The jury, however, took an entirely different view of the case, which resulted as above stated.

This litigation, trival in itself, suggests the question whether meters are in all cases and under all circumstances reliable in their indications. The millions of consumers require something more than the mere assertions of gas companies and meter manufacturers to satisfy them on this point. They demand to be assured of the correct registration of the meters ere they will submit to their arbitrary indications, and the precedent having been established in the case above referred to, we shall doubtless hear of other disputes being left to the decision of a jury, by consumers who are not disposed to calmly submit to other dicta.

In all civilized countries attention is paid to regulating weights and measures by laws, and severe penalties are inflicted for the slightest deviation from the legal standard. It seems remarkable, then, that no provision should have been made, in many States, for the official inspection of such a complicated apparatus as a gas-meter. This is altogether wrong, and should be remedied at once. Laws for the inspection and sealing of meters should be immediately adopted in all those States where such statutes do not exist, and consumers should insist upon their being passed and enforced.

We believe that by far the largest proportion of meters are correctly made, and register the exact amount of gas which passes through them with undoubted accuracy, or if they err at all, err in favor of the consumer, by allowing the gas to pass through them unregistered.

There are some manufacturers whose meters we would implicitly trust in, knowing them to be made and adjusted with the minutest accuracy. But there are others which we know to work with great uncertainty, and to exhibit their unreliability when submitted to the inspector's test. As many gas companies buy indiscriminately from different makers, in places where there is no inspection law the consumer is liable to suffer from an imperfect meter. In this case, the maker of the best instruments is sure to suffer by having suspicions directed to his meters; the prejudiced opinion of the public being that if one is unreliable others may be as little worthy of confidence. We are satisfied that the manufacturers of correct instruments will second the efforts of consumers desirous of being protected by any reasonable law for the sealing of meters, as they feel secure from any penalties or aspersions which might be put upon them from lack of care in producing a reliable apparatus.

On page 219, we published the law of the State of New York, for the inspection and sealing of meters. This law has now been in operation more than two years, and under the able superintendence of the present inspector, it has been found to work well and to establish a feeling of security among consumers. The test to which the meters are exposed is a very accurate one, and well calculated to exhibit the least evidence of incorrectness. Should a consumer in this State feel aggrieved at his bill, and deem himself wronged by the gas companies, he has but to send for the inspector to examine the meter. The word of this official is law. No appeal can be made from his decision; for he is fortified by facts, and his opinion is binding. We trust that ere long inspection laws will be enforced in other parts of the country where none now exist, and we are confident that these laws, if rightly framed, will do much to restore harmony and confidence between the companies and their customers.

CORROSION OF IRON WATER-MAINS.

The deposits which form in the interior of iron water-mains cause serious annoyance and loss to many of our water companies. To so great a degree does this evil extend, that strenuous efforts are being made to substitute some other material for iron, which shall possess all its valuable qualities, and at the same time be free from liability to corrosion, and consequent obstruction. Of late years, the complaints on this account have largely increased, and engineers have been making the subject one of much reflection and study, with a view of arriving at a satisfactory means of obviating the difficulty.

The appearance of this internal deposit is very singular, and it assumes various modifications. Sometimes the corrosion is of a uniform thickness, and appears to attack the surface of the iron evenly, while at others the whole diameter of the pipe is clogged with tubercles of various sizes and shapes, occurring at irregular intervals. The effect of this incrustation is obviously very disastrous to the economical distribution of water, as the diameter of the mains is so much diminished as to reduce their capacity to that of pipes of much smaller calibre than they were originally constructed. In addition to this, the strength of the pipe is much impaired by this process of oxidation, and it is rendered much less able to bear sudden concussions and heavy pressure than previous to the formation of the deposit. This must be apparent to all intelligent observers, for it is at the expense of the iron that the incrustation occurs. These facts are but too well known to engineers, who are fully cognizant of the difficulty under which they labor in endeavoring to remedy the evil.

It has been a question with practical men, whether to substitute some other material for iron, or to adopt some means of internally coating iron mains so as to preclude all possibility of the formation of accretions. Thus far no satisfactory explanation has been given of the cause of this peculiar deposit. That it is a species of oxidation is very clear, since the mass formed has all the external characteristics of iron rust; but why it should assume such peculiar physical properties, and present a configuration so unlike the outward forms of other oxidation, has not yet been satisfactorily explained.

Methods have been tried to coat the interior of iron water-pipes with some substance which would protect the surface of the iron from contact with the water. This would seem to be the only remedy, but it is likely that it would be attended with so much expense as to remove one of the strongest arguments in favor of the employment of iron—viz., the economy of its application. In Brooklyn the Water-Board have coated the interior of iron mains with a mixture coal-tar and linseed oil, which is applied at a high temperature. We have not heard whether this remedy has been effectual in checking the formation of accretions. It is said to impose an additional cost of $2.50 per ton on the mains.

Among the materials, other than iron, which have been recommended and used to some extent for water-pipes, are wood, banded wood and cement, sheet-iron and cement, and bituminized paper. Wooden pipes have been immemorially employed in some places for distributing water, and are still used in many instances. Pipes made of wood and cement have also been adopted to a limited extent. They are durable, easily laid, and have been made to withstand a pressure of 400 lbs. to the square inch. The pipes constructed of sheet-iron lined and coated externally with hydraulic cement are said to be well adapted for the purpose of distributing water, and as the iron is entirely protected from contact with the water, they are free from all danger of being clogged by tubercular deposits. This description of pipes has been made to stand a pressure of 240 feet head of water. In England, pipes made of bituminized paper have been employed in distributing both water and gas, but we have not heard with what result.

Another description of pipe is made by Mr. WM. STEPHENSON, of Fremont, Ohio, and is constructed of wood, being bored from the solid log, lined with cement and coated exteriorly with coal tar. This form of pipe is said to be extremely durable, and not being subjected to expansion and contraction by change of temperature, is entirely free from leakage. A sample of this pipe may be seen at the rooms of the JOURNAL where those interested would do well to call and examine it.

From the unsatisfactory experience of most engineers with iron mains, it is evident that any improvement removing the tendency to oxidation is much needed. In England and France, as well as in this country, the complaints on this score are loud and deep, and a wide field is open for enterprise in introducing an effectual remedy.

GAS LEAKAGE FROM STREET MAINS.—With reference to this subject, Miss Martin reminds us that her late father, Mr. John Martin, took out a patent some years since for a pipe junction, which, from a painted description forwarded to us, appears to have consisted of a coupling of metal in two pieces, and forming a band suitable for embracing the ends of the pipes when laid close together; there being dovetailed projections on the band for enclosure by dovetailed slips for securing the pieces of the band: both slips and dovetailed projections are wider at one end than the other, so that, when forced on, the whole is wedged tightly together, after a coating of cement, such as white-lead or pitch combined with tar, or thin felt, saturated with pitch, has been laid on. Mr. Martin intended his coupling either for cast-iron pipes, or those of fire-clay; but he was desirous of having gas-pipes of glass, connected by the metal bands; thus giving effect to Sir Robert Peel's suggestion of glass pipes.—*London Builder.*

DISCOVERY OF A COAL VEIN.—It is stated that Mr. George Seanor, of Enon Valley, Pa., whilst boring for oil a short time ago, at a depth of 180 feet, struck upon a vein of coal over fourteen feet in thickness.

GUTTA PERCHA SERVICE PIPE.—This material is superseding lead in some places, owing to its freedom from impurity, and from the effects of cold weather, and corrosion.

ANSWERS TO CORRESPONDENTS.

U. A. T., of Maine.—*The distillation of coal for oils for illuminating purposes will doubtless be soon discontinued, as it is much more profitable to use the natural product, petroleum, which is now so abundantly supplied from the numerous wells in some of our neighboring states.*

E. T. W., of Conn.—*Samuel Hughes, of London, Eng., the author of a very imperfect treatise on gas-lighting, has also written a book on the subject af water-supply for cities and towns. It is published in John Weale's rudimentary series. We have not read the book, but hope it will bear a closer scrutiny than his work on gas.*

A. J. E., of N. Y.—*A large number of persons claim to have been the original inventors of the dry meter. We believe that the honor of first contriving this important instrument belongs to Mr. James Bogardus of this city, who is widely known on account of his many useful inventions, and as the pioneer in the use of iron for the erection of buildings.*

J. C. L, of N. Y.—*It would take a volume to even mention the numerous classes of hydro-carbons which are found in coal oils. We agree with you that a complete work is much needed on this subject, which has grown to be one of great magnitude. The German chemists have pushed their investigations in this field in advance of those of any other country.*

E. A. B, of N. J.—*The best familiar treatise on dyeing and calico printing with which we are acquainted, is in "Brande's Lectures on Chemistry applied to the Arts." There are many more explicit books than this, but for what you want it is just the thing to impart the principles of the art.*

A. L. D., of Pa.—*A difference of opinion exists as to the material of which stills should be constructed. Some parties prefer wrought iron, but we think cast iron is used to a greater extent.*

B. J. S., of Md.—*In England 12 candles is a fair average. In this country it is little higher—about 14 candles.*

O. E, of N. C.—*The English Parliamentary burner is an Argand, with 15 holes. The chimney is 7 inches high.*

J. E. B., of Ala.—*The Worthington pumps are very highly spoken of wherever used. All of our large city gas companies are supplied with them, and their performance is spoken of in the most favorable terms.*

E. B. McC., of Tenn.—*We have not yet received any reliable accounts of the experiment, but are inclined to believe it to have resulted in a complete failure. We will notify you through our columns should anything interesting transpire.*

PURIFICATION OF COAL GAS FROM BISULPHIDE OF CARBON.

By the Rev. W. R. Bowditch.

(Read before the Royal Society of London.)

A distinguished Fellow of the Royal Society discovered coal gas, when rector of Crofton, about two miles from my present parish, and nearly all our knowledge of this complex substance is derived from the labors of chemists, who have been, or are, Fellows of the Society. I feel assured, therefore, that an attempt to extend the knowledge of the reaction of coal gas with various substances will be favorably received, and that the application to practice of the facts made known, will not render a memoir less acceptable to the society which rewarded alike the abstract researches of Leverrier and the practical ones of Arnott.

Six years ago, I introduced the use of clay into gas-works for the purpose of improving the purification of coal-gas, and now—after so long an experience, the purification of many hundreds of millions of feet of gas, and the use of many thousand tons of the refuse as manure—I venture, for the first time, to submit the grounds upon which my process is based.

Coal gas may conveniently be considered under the heads of carbon compounds required for the production of heat and light, which generate water and carbonic acid by their combustion; and sulphur and nitrogen compounds which are not necessary for heat and light, and ought to be removed from gas on account of the injurious nature of the substances produced by their combustion.

The former of these classes will be treated of incidentally; the latter class forms the principal subject of this paper. When speaking of *gas* I always refer to that which has undergone the ordinary condensation of gas-works, wherefore no mention is made of the complex compounds removed by condensation.

When coal is distilled, its nitrogen is evolved in some forms of combination which are generally familiar, while others are almost unsuspected. Under certain conditions of distillation, much nitrogen leaves the retorts and passes the condenser as ammonia, or some of its salts. These are all removed from gas by clay, so that no trace of ammonia can be discovered, after gas has passed through purifiers charged with an adequate quantity of clay, and with lime or some equivalent substance to remove sulphide of hydrogen. Clay is thus entitled to be classed with acids and some metallic salts as a purifier of gas, for these, of course, remove ammonia and its salts. But between clay and acids there is an important difference, in regard to the action which takes place upon the most valuable light-giving constituents of the gas; acids remove a large quantity of these; clay does not. We have experimental proof that clay does not remove the valuable hydro-carbon vapors from gas, in the fact that strong spirit of wine, digested upon foul clay for days, does not thereby become much more luminous than it was before being so treated. The very slight light-giving power which it has obtained is due to tar; for, if the spirit be evaporated, and the tar so obtained be redissolved in fresh spirit, the same kind of flame will be obtained as before; whereas, the addition of a small portion of coal oil to spirit gives a flame of considerable illuminating power. To this I may add, that long and extensive experience shows that the employment of clay in the purifying process improves the light-giving power of gas, by removing substances which are not otherwise removed, and which, if allowed to be burnt with the gas, lessen its illuminating power. These light-damaging compounds are produced during the latter portion of the distillatory process, as I have proved by experiment. The same retort was charged twice with the same weight of the same coal. The gas produced by one charge was purified by lime only; that produced by the other charge was purified by lime and clay. The illuminating power of the gas passing at each half hour's end was determined, and it was found that the purification made no difference for the first three or four half hours. About the middle of the charge, that purified by my process had slightly the advantage, and at the close the difference in favor of that purified by the addition of clay has been found as much as 10 or 12 per cent. Thus it is shown that the compounds removed by clay from gas produced during the early stages of distillation—however objectionable on other accounts—do not lessen the light-giving power of gas; whereas, those removed during the latter periods of distillation, reduce the light-giving powers considerably.

If conjectures be allowable, I would venture an opinion that cyanogen compounds, and other nitrogenized substances, with which foul clay abounds, are those which lessen light. My own investigations lead directly to this inference, and, I think, explain an old table by Dr. Henry in this sense. In the "Philosophical Transactions" for 1808, he shows that the gas produced from 112 lbs. of cannel coal contained, after purification, the following quantities of nitrogen:

Hours from commencement of Distillation.	100 Measures of Purified Gas contain Measures of Nitrogen.	
½ an hour	20	Due chiefly to atmospheric air.
1 hour.....	4¼	Probably the time when ammonia was principally produced.
3 hours....	5	
5 "	15	Probably vapor of water was present in very small quantity and cyanogen and related compounds were produced in increasing quantity.
7 "	15	
9 "	15	
10½ "	20	
12 "	20	

Without assuming the absolute accuracy of these figures, we may regard them as valuable indicators, pointing, I think, in the direction I have ventured to conjecture.

A beautiful reaction furnishes experimental proof of the damage done to gas by acids. Clean deal sawdust is well moistened with pure sulphuric acid, diluted with five or six volumes of water, so that the sawdust may not be discolored, and gas is passed through it in a slow stream. With rich gases, which give the light of from 20 to 25 sperm candles for a consumption of 5 feet an hour, the sawdust instantly changes to a most beautiful pink color, and the tint gradually deepens until the whole becomes of a dark mahogany. With poor gases, which give the light of from 10 to 12 candles, this coloration is exceedingly faint at first, and deepens very slowly. The differences of coloration are so considerable and constant, that I have no doubt of the possibility of thus determining the value of color, would give a close approximation to the illuminating value of the gas as an illuminant. By using a standard acid, the same kind of sawdust, a uniform volume of gas, and the same sized U-tubes, notation of time and depth of color would give a close approximation to the illuminating value of the gas. At all events, the sources of error are not greater than those of photometry in the hands of all but the most experienced, and the process is quite as close an approximation to truth as an ultimate analysis of gas, containing, as it does, impurities which render skill and precaution useless. A comparison of the analysis of coal gas given in "Bunson's Gasometry," with the substances now known to exist in gas, will convince us that at present we cannot attach any value to such analyses.

To determine the substances in gas which produce this coloration, some of its chief illuminating constituents were prepared and passed separately through the acid sawdust.

Olefiant gas made in the usual manner, and carefully purified, reddens the acid sawdust. Ether vapor does not affect it, and therefore need not be removed from the gas for this experiment.

Propylene, produced by passing the vapor of fusel-oil through a red-hot combustion tube, filled with cast-iron nails, but kept at so low a temperature that a small portion of oil passed over without decomposition, reddened the acid sawdust.

Commercial benzole, with the exception of one specimen, reddened the acid sawdust.

I have not yet had leisure to prepare and test acetylene.

The coloration of fir-wood, moistened by hydrochloric acid, has been mentioned by Williams as characteristic of pyrrole.

To show that the color was produced by illuminating matter abstracted, some sawdust was treated with acid strong enough to char it slightly;* and gas which instantly reddened the clean sawdust and dilute acid, was passed first through the black and then through the clean acid sawdust. No color was produced in the latter, though the flow of gas continued for an hour.

Hydrochloric may be substituted for sulphuric acid, so far as that gas colors sawdust moistened with it, but it is liable to a considerable disadvantage. If gas contain ammonia, the vapor of the acid unites with it in the tube before the gas comes into contact with the sawdust, and the result is a deposit of chloride of ammonium on the surface of the sawdust where the color commences, which renders the observation less precise and easy. Olefiant gas likewise does not redden this acid sawdust, and therefore cannot be estimated by it.

Nitrogenized compounds in gas, present the greatest difficulty in the way of efficient purification, and the almost impossibility of obtaining them in a state fit for examination, renders their investigation laborious and unsatisfactory. Much nitrogen is contained in gas as cyanogen, which can be separated from the clay used in purification. Probably not much less exists as sulphocyanogen, which can be separated from the foul clay with ease, and the presence of further quantities in combination with sulphuretted hydro-carbons and tar can be demonstrated. The bodies formed by this combination of elements are, I believe, unknown at present.

By placing clay in a purifier through which crude gas passes from the condenser of a gas-work, and treating the saturated clay with spirit, a solution is obtained, of a brown color, which has no effect upon litmus, turmeric, or lead-paper, which decolorizes a solution of iodine, and from which nitrate of silver throws down a white, or brownish white precipitate, and acetate of lead a white precipitate. The aqueous solution possesses the same properties, and, like the solution in spirit, is always neutral. Litmus paper, immersed in either of the solutions and exposed to the air, becomes quickly, strongly, and permanently reddened. Soluble sulphides have been tested for repeatedly with nitroprusside of sodium, as well as with acetate of lead, but

* This acid was of the same strength as that used in some gas-works.

have never been found; yet a sulphur compound exists in solution which possesses the power of forming a sulphide with metallic mercury. The spirit solution, digested on mercury, with occasional shaking, produces the black sulphide of mercury, while the aqueous solution, similarly treated, produces the red sulphide. Insoluble sulphides, however, exist in the foul clay, and evolve sulphide of hydrogen on the addition of an acid. These insoluble sulphides are oxidized rapidly by exposure of the clay to atmospheric action.

A solution of clay in spirit was treated with an excess of powdered acetate of lead, and the white precipitate filtered off. The brown filtrate and supersaturated with ammonia and filtered. The clear brown filtrate, diluted with twelve times its bulk of water, became milky, and with much difficulty was obtained clear by filtration. Part of the spirit was then distilled off, to ascertain whether it would bring over a volatile sulphur compound; but the spirit was quite free from sulphur. The remaining fluid was then acidified with nitric acid, which caused brisk effervescence and a strong smell of hydrocyanic acid. Nitrate of silver was added as long as it continued to produce a precipitate; the precipitate, dried and heated, gave off cyanogen, which burnt with its characteristic flame. The clear filtrate, slowly evaporated to dryness, left a pale yellow crystalline mass, which did not change color by several days exposure to light. Part of this, burnt in a porcelain crucible, gave off nitrous fumes, and left a considerable residue blackened by oxide of silver. Water was added to this residue, and the oxide of silver filtered off, and an abundant precipitate of sulphate of baryta obtained, with a salt of baryta. The remainder of the yellow salt was redissolved in water, with a view to separate a granular portion which was mixed with the more perfectly crystalline salt, but an accident unfortunately spoilt the remaider, and rendered any further progress impossible.

Sulphocyanide of ammonium may be obtained in considerable quantity from an alcoholic solution of foul clay. Upon one occasion I obtained nearly an ounce, in a fair state of purity, from less than a quart bottle of foul clay; and so tenaciously does clay retain this compound that, from some clay which had been exposed to the full action of the weather in a field for two years, I obtained a considerable coloration with perchloride of iron. Sulphocyanide of ammonium may be obtained from gas which has even purified by oxide of iron, by passing the gas through spirit of wine, and evaporating.

When common yellow brick-clay is used in the purification of coal-gas, the solutions from it always contain salts of iron, but they never become of a blood-red color until a mineral acid is added. When, however, the solutions are evaporated, and the deliquescent residue is exposed to the air, most, and sometimes all of the iron is peroxidized, and yields the well-known reaction.

The nitrogen in tar may be shown from the spirit solution of foul clay. The spirit, evaporated to dryness, and allowed to stand, deposits tar and a mixture of deliquescent crystalline salts. They were allowed to deliquesce, the fluid was removed, and the residual tar well washed with water. Subsequently, it was dissolved in hot spirit, precipitated by water, and well washed. When nothing more was removed by washing, the tar was heated, and evolved sulphide of hydrogen and ammonia. Contrary to every other compound in gas with which I have experimented, this tar gave off sulphide of hydrogen before ammonia. In other instances, I have found the nitrogen compound evolved at a lower temperature than the sulphur one.

Mineral matter derived from the clay is found in all solutions; but, as my object in this paper is to speak only of substances in gas, I purposely omit those united with them derived from the clay. For the same reason, I make no mention of the value of the foul clay as a manure.

(To be concluded.)

Woburn, Mass.—Gas-works built by Walker & Norton, and are, in most respects, satisfactory. Use iron retorts; wet meters from Samuel Down; dry meters from Glover, of London; an eastern gas-holder; some four miles of mains joined with cement; Pictou coal used, at $5.32 per ton of 2,240 lbs.

FORMS OF BLANKS USED BY GAS-LIGHT COMPANIES.

GAS COMPANY'S RECEIPT FOR COST OF PIPES.

Office of the Manhattan Gas-Light Company,

New York, _____ 186

Received *from* _____ *Dollars, for Service Pipe from Curb and Proof of House, No.* _____ *Street, the Service Pipe to be for the use of the said premises.*

ORDER FOR GAS-METER.

No. **Office of Manhattan Gas-Light Company,**

New York, _____ 186

Deliver a _____ *Light Meter for* _____

NOTICE TO AN INCOMING TENANT TO ORDER THE GAS.

DESK, No. _____ **Office of the Manhattan Gas-Light Co.**

Corner of Irving Place and 15th St. _____ **186**

The occupant of No. _____ *Street, is hereby respectfully requested to give notice at this office (if Gas is required) on or before the* _____ *inst., to sign an order and make the usual deposit as security (if required), so that the Index of the Meter may be taken (if not already done), in order that the present occupant may not incur any liability for Gas consumed by the predecessor, and also to have a correctly ascertained point from which to start the successor's account, which can be done only by a strict compliance with the requirements of this notice.*

No. *Vice-President.*

ORDER TO REMOVE METER AND FIXTURES.

No. _____ **Manhattan Gas-Light Co.** 1861.

M _____

Residence, No. _____ *Street,*

Get _____

Key at _____

Removed to _____

Desk, No. } *Index, Fo.* *By* *Date*

GAS-FITTER'S APPLICATION FOR PIPE.

New York, _____ 186

Service Pipe wanted by _____

in the premises No. _____ *Street, to be occupied as a* _____

_____ *Fitter.*

CERTIFICATE OF DEPOSIT.

Preserve this Receipt with care, and do not transfer it to any other person.

Office of THE MANHATTAN GAS-LIGHT COMPANY,

No. 4 Irving Place, N.Y.

No. _____ **NOT TRANSFERABLE.** $_____

New York, _____ 186

THE MANHATTAN GAS-LIGHT COMPANY *has received from* _____ *the sum of* _____ *Dollars, as security for payment for Gas to be supplied and used at No.* _____ *Street, New York, pursuant to application of this date, which sum, with interest to the date of the final bill for Gas, will be repaid to said* _____ *on final settlement and on the return of this receipt; provided all bills for Gas supplied under said application are regularly paid.*

_____ *Cashier.*

Received on _____ 186 *of* The Manhattan Gas-Light Company, *payment of the above-mentioned sum of money, with interest.*

$.....

NOTICE TO LODGE A DEPOSIT.

Office of the Manhattan Gas-Light Company,

Corner of Irving Place and 15th St.

New York, _____ 186

Mr. _____

Dear Sir,

Please call at this office, on or before the _____ *and make a* **Deposit** *of* $_____ *for the use of Gas at No.* _____ *Street, for which you have signed an order, and oblige,*

Your obedient servant,

Vice-President.

REGULATION OF THE SIZE OF TUBING.

Office of the Manhattan Gas-Light Company,

Corner Irving Place and Fifteenth Street.

New York, *May,* 1860.

The following REGULATION of the size of Tubing, &c., &c., to be used hereafter in the fitting up of Dwelling Houses, &c., having been adopted by the Board of Directors, is distributed for the information of GAS FITTERS, and of persons desiring to have their Dwellings, &c., fitted up.

All Mechanics fitting up Dwelling Houses and other places for the introduction of Gas, will hereafter be required by the Board of Directors of the Manhattan Gas-Light Company to conform strictly to the following directions, in order to insure the approval of the Company's Chief Inspector, Mr. Thomas Marsh, and the consequent introduction of the Gas; and, *also*, to include in their estimates, in the case of Dwelling Houses, Hotels and Halls, ten dollars for laying the service pipe to the curb, and the proof of the work, and in the case of Stores, five dollars for laying the service pipe to the curb, which sums respectively they are hereby required to pay to the Company on leaving their order for the same.

SIZE OF TUBING.	GREATEST LENGTH ALLOWED.	GREATEST NO. OF BURNERS.	SIZE OF METERS.	GREATEST NO. OF BURNERS.
¼ Inch.	6 Feet.	1 Burner.	3 Light.	6 Burners.
⅜ "	20 "	3 "	5 "	10 "
½ "	30 "	6 "	10 "	20 "
⅝ "	40 "	12 "	20 "	40 "
¾ "	50 "	20 "	30 "	60 "
1 "	70 "	35 "	45 "	90 "
1¼ "	100 "	60 "	60 "	120 "
1½ "	150 "	100 "	100 "	200 "
2 "	200 "	200 "		

S. H. HOWARD, *Secretary.*

CHARLES ROOME, *President.*
FLOYD SMITH, *Vice-President.*

CONSUMER'S ORDER FOR SUPPLY OF GAS.

TO THE MANHATTAN GAS-LIGHT COMPANY.

*The Subscriber requests The Manhattan Gas-Light Company to supply him with Illuminating Gas, at the premises No.*_____

New York, occupied as a _____

and, in consideration of being so supplied, promises to take such Gas only through a Meter supplied or approved by the Company and placed in said premises; to pay said Company in payments, pursuant to its rules, at the established price, for all Gas supplied to him, as indicated by such Meter or otherwise ascertained, up to the time when notice shall be given to the Company, at its office, to discontinue the supply; to deposit with the Company, as security for the payment for Gas supplied, such sum as shall be sufficient to pay the bills therefor for two , on which deposit the Company shall pay interest up to the date of their final bill for Gas; to keep such Meter in good order, and deliver it to the Company when this arrangement ends, or then pay the Company the value thereof; to protect said Meter and the Gas-pipes from frost and from damage, and allow the agents of the Company free ingress and access at all reasonable hours, to inspect the Meter and to exchange the same if imperfect; to give, when requested, a correct account of the number and size of the Gas-burners or lights used in said premises and of the time they are used per day; and in default of performance of this agreement by the subscriber, the Company is authorized to enter said premises and remove said Meter, or otherwie stop the supply of Gas.

*Dated New York,*_____ 186 *Send Bill to*_____

NEW CONTRACT FOR CROTON WATER MAINS.—The Croton Board have lately awarded to Messrs. Colwell & Co., of Philadelphia, the contract for furnishing 4,200 feet of five-foot pipes, which, when completed, will be the largest cast-iron pipes ever made in this country. These are intended to bring across the Manhattan Valley the increased supply of water which will be furnished by the new seven-foot pipes over the High Bridge, and will be in addition to the pipes now laid in that locality, viz, one of four feet, and two of three feet. The laying of the pipes over the High Bridge is progressing with all the rapidity consistent with a due regard to the ultimate security of the work, and when finished, together with the new pipes over the Manhattan Valley, and the four-feet pipes laid in the Fifth avenue, connecting the new receiving and the distributing reservoir, the city may enlarge its boundaries to the full limits of the entire island without any danger of a lack in the supply of the Croton. As the Croton Board is not now compelled to wait the ofttimes tardy action of the Common Council, in confirming their awards of contracts, this important work will be commenced immediately, and prosecuted with energy.

Messrs. Colwell & Co. were among our earliest friends, and are well known as among the most enterprising iron founders in this country.

DRINKING FOUNTAINS IN ENGLAND.—The time has arrived for the revival of this movement after the lapse of winter. At Spalding a fountain is to be erected by subscription as a memorial of a townsman. The design, by Mr. Wm. Brown, of Spalding, architect, consists of an Ionic portico of four columns upon a base, the whole structure being about 17 feet in height, with a fountain in the centre flowing into three vases and trough below. At Derby a fountain is to be erected on one side of the Corn Exchange in honor of the mayor and high sheriff of the city. Mr. Wilson, architect, has produced a design. The cost will be about £120.

BITUMINIZED PIPES.—The demand for bituminized water, gas, and drain pipes, seems to be considerably increasing in England, where the manufacturers have been compelled to enter into a contract for the erection of an addition to their already extensive works.

FISHKILL, N. Y.—A dividend of four per cent. was paid on April 15th, upon the capital stock of this little Rosin Gas Company, under the judicious management of James E. Van Steenbergh, Esq., who is also cashier of the Fishkill Bank.

LAFAYETTE, IND.—Gas-works built by W. D. Parrish, with Morris, Tasker & Co.'s iron retorts, Code, Hopper & Gratz's meters (wet and dry), Deily's gas-holder; no exhauster; use Pittsburgh and Indiana coals—half and half—former at 22 cents and latter at 12 cents per bushel. Mr. Charles Collier, Supt., has always been attentive and prompt in replying to our enquiries, and sent us an interesting table of product of his works since they were built, which our space will not admit. We are no less obliged to him, however.

RIPLEY, O.—Builders of the gas-works, Messrs. Miller & Runyan, of Springfield, Ohio; iron retorts from S. S. Ashcraft & Co., Cin., O. Use no exhauster nor photometer. Pittsburg Coal, costing from 8 to 10 cents per bushel, delivered. They have about 9,000 feet of main pipe, 4, 3 and 2 inches. Have been in operation four months; have no station meter. Works prove satisfactory so far.

JANESVILLE, WIS.—The mortgage bondholders of this company, have at length wearied of the bad faith, bad management, and bad prospects, and signed a requisition upon the trustee to foreclose the mortgage at once. We advised this course on page 81 of Vol. I., Nov. 1, 1859. There will be a rare *exposé* of this concern if we can get hold of its private history. It will be remembered that it has been saddled with two boards of directors at the same time, who appear to have ridden it to death.

LONDON, C. W.—Gas-Works built by Edward Glackmeyer, the manager and Engineer of the company, and are very satisfactory. Use iron retorts of Canadian manufacture; Laidlaw & Sons', of Glasgow, station meter; Thomas Glover's, of London, meters; J. Stewart & Co.'s, Glasgow, gas-holders; lead and also turned and bored joints; Pittsburg, Pa., coal, at $7 per ton of 2,000 lbs.; 8 miles of mains from 6 to 2 inches diameter. Bonded indebtedness, $50,000 at ten per cent interest.

HAGERSTOWN, MD.—Coal gas-works, built by the Maryland (Portable) Gas Co. This report is likewise rather old, the Company having just changed from rosin to coal.

JOLIET, ILL.—These are considered by the company as the most economical gas-works in the United States; no leaks inside or out; consumption and income steadily increasing, while the expenses are being gradually reduced. E. WILCOX, President.

Made in 1860 as per station meters	2,004,060
Sold in 1860 " consumers' meters	2,005,575
Increase by expansion, cubic feet,	1,515

THE COAL TRADE.—The coal trade of Pennsylvania for 1860, amounted to 9,528,024 tons, of which 8,131,234 tons were anthracite, 1,156,093 semi-anthracite and bituminous, and 240,697 imported. The increase in anthracite this year is 613,717 tons, and the other kinds gave an increase of only 24,519 tons, making the increase for the year 638,232 tons, against 1,115,399 tons, the increase in 1859 over the supply of 1858. Of the whole supply of hard anthracites sent to market in 1860, Schuylkill county furnished 3,292,828; the other regions 4,838,578. Balance against Schuylkill county 1,545,572. In 1856, Schuylkill county furnished more than one-half the anthracite coal sent to market—this year she falls short of half the supply, 1,545,578 tons.

GAS IN IRELAND.—The small town of Tuam, near Galway, Ireland, has been lighted with gas. A company has been formed with a capital of £3,000. A site for the works was obtained, and the Directors advertised for plans, offering a reward of £15 for the best. Mr. W. Daniel, of Dublin, was the successful designer, and to him was also awarded the contract for the erection of the works. The town was first lighted on Jan. 7th.

LARGE GAS-HOLDER.—It is said that the Imperial Gas Company of London, are contemplating the erection of a gas-holder 300 feet in diameter. The great gas-holder at present in use by this company, is 201 feet in diameter. The largest gas-holder in this country is at the Philadelphia gas-works. It is 95 feet high, and 163 feet in diameter.

PATENTS.

UNITED STATES.

957.—William Dripps, of Coatsville, Pa., for an Improvement in Waterwheels:

I claim, in combination with a spiral cased water wheel, the making of a water chamber between the bottom of the wheel and the bottom of the case that is supplied by ingress at the joint, for the purpose of raising the toe of the wheel, as set forth.

I also claim the converting of that part of the casing, e c, into a spring, so that it, as well as the continuation of it, d, may yield to any hard substance that may get into the wheel, substantially as described.

I also claim, in combination with the buckets of a water wheel, the flanges, f, for the purpose of preventing the water, when there is but a small supply, from rising up on the bucket, and thus wasting much of its force, substantially as described.

978.—J. J. Johnston, of Alleghany, Pa., for an improvement in the Distillation of Hydro-carbon Oils:

I claim the process and method of purifying, decolorizing, and dedorizing rock or petroleum oil, by distilling it with common wood charcoal, in proportions substantially described.

979.—Anson Judson, of Brooklyn, N. Y., for an Improvement in Lamps:

I claim the contraction of the cone, A, or its equivalent of glass or other transparent material, as and for the purpose described.

981.—John Laing, of Hoboken, N. J., for an Improved Gas Generating Steam Boiler:

I claim, first, Combining one or more retorts, A, with a steam boiler, C, substantially in the manner and for the purpose specified.

Second, The arrangement of a series of gas-pipes, E, and air-holes, d, in combination with the secondary fire-chamber, D, of a steam boiler, G, constructed and operating substantially in the manner and for the purpose shown and described.

Third, The arrangement of the three-way cock, N, and conical vessel, Q, in combination with the tanks, P P', and retort or retorts, A, constructed and operating substantially in the manner and for the purpose set forth.

Fourth, Mixing the oil and water before it passes into the retort or retorts, as and for the purpose described.

Fifth, The arrangement of the two gasometers, L and O, rod, m, weighted arm, p, or its equivalent, three-way cock, N, and rock-shaft, o, in combination with the supply tanks, P P', and retort or retorts, A, constructed and operating substantially in the manner and for the purpose specified.

982.—Mark Levy, of New York City, for an Improvement in Retorts for the Manufacture of Gas from Wood:

I claim the arrangement and use of the elliptic-shaped retort, A, with the central unremovable reheating flues, E E' E, &c., dividing said retort in two parts, constructed and combined together in the manner and for the purpose substantially as described.

987.—Henry Napier, of Brooklyn, N. Y., for an Improvement in Apparatuses for Manufacturing Turpentine and Resin:

I claim the arrangement together for joint operation, in the manner substantially as shown and described, of the jacketed vacuum, straining vessel, A, retort, B, boiler, C, and condenser, D, for the purposes set forth.

[The object of this invention is more especially to obtain a very superior and colorless resin.]

994.—Abraham Quinn, of New York City, for an Improvement in Apparatuses for Distilling Oils:

I claim the rectifier, composed of the inverted siphon, E F, with its faucets and other appendages, substantially as described, applied in combination with the still and condenser, in such a manner as to be capable of effecting the several operations and purposes set forth.

1,000.—I. D. Seely, of Milford, N. Y., for an Improvement in Water Wheels:

I claim the stop or cut-off E, in connection with the buckets a', cylinder, C, and chute, F, arranged relatively with each other, for joint operation as described.

[This invention relates to an improved water wheel of that class in which it is designed to obtain power from both the direct and reacting force of the water; or, in other words, by impact and reaction. The object of the invention is to obtain a very simple wheel of the kind specified; one that may be economically constructed, and will give a large percentage of the power of the water employed to operate it.]

1,008.—J. I. Storer, of Philadelphia, Pa., for an Improvement in Desulphurizing Coal and Ores:

I claim the employment, in the manner specified, of ammonia in connection with steam in the process of desulphurizing coals and ores.

1,015.—S. H. Walker and M. C. Walker, of Boston, Mass., for an Improvement in Gas Retorts:

We claim a horizontal retort formed with a flat bottom and cylindrical flanged ends, and taperi g gradually in size from the center toward each end, in the manner shown and described, and for the purposes explained.

[This improvement is more particularly designed for retorts for generating gas from melted rosin or other hydro-carbons which are in a naturally liquid state or become liquified by heat. Its object is to obtain a more equal distribution of heat throughout the whole length of the retort, and to this end it consists in making the retort of larger caliber and with greater generating surface at the middle of its length, or decreasing in caliber from the middle toward either or both ends.]

1,025.—A. M. Colver, of Albion, Mich., for an Improvement in Rotary Pumps:

I claim the pistons, H H, passing through the cylinder, I, and revolving round a center, G, in the manner specified, when said pistons, H H, are formed thinner in the middle, and with the curved sides, for the purposes and as specified.

1,026.—G. W. Martin, of Morrisania, N. Y., assignor to himself and William Shepard, of Tremont, N. Y., for an Improvement in Pumps:

I claim the pipes, b and c, valves, n and o, arranged as specified in combination with the air vessel, d, and piston, e, for the purposes and as set forth.

And, in combination therewith, I claim the arrangement of the deflectors, l and m, in the reservoir, h, for the purposes specified.

1,106.—J. E. Ambrose, of Lena, Ill., for an Improvement in Lamps:

I claim, first, The employment or use of the water chamber, C, communicating through a stoppered opening with the body or fountain, A, of the lamp, and arranged to operate substantially as and for the purpose set forth.

Second, The arrangement of the springs, k k, shaft, g, and wheels, h h, substantially as shown, for elevating and lowering the wick, as described.

Third, The combination with the cone, K, of the short tube, I, adapted and employed in the manner set forth, for the attachment of movable inner deflectors of various forms.

Fourth, The plate, N, provided with the slot, s, and pendents, t, operating in connection with the outer cone or deflector, K, in the manner and for the purposes set forth.

[This invention relates to a new and improved lamp for burning paraffine and the various coal oils in use. The object of the invention is to obtain a lamp which will burn the materials above specified without a chimney, and one which is portable or may be used as a hand lamp and carried, while burning, from place to place without smoking or emitting a disagreeable odor.]

1,114.—M. L. Callender, of New York City, for an Improvement in Lamps:

I claim the bifurcated wick tube, f, and its arms, e e', by which two wicks can be elevated or depend simultaneously.

Second, I claim the combination of the cap, b b', the deflector, c c', and the cap, d d', with the bifurcated wick tube, f, and its arms, e e', and the bifurcated shield, a a, with its arms, y y', for supplying the interior of the flame with a current of heated air, and the outer surfaces of the flame with currents of cool air, for the purpose and in the manner specified.

1,120.—John Danks, of Troy, N. Y., for an Improvement in Burners for Purifying Gas:

I claim the employment as filling for a chamber, B, applied in combination with a burner, substantially as described, of hemp or flax saturated with nitric acid, as set forth.

[This invention consists in furnishing a gas-burner with a chamber filled with hemp or flax saturated with nitric acid, said chamber being so arranged that the gas, on its way to the external orifice or orifices of the burner, is caused to pass through the interstices between the fibers of the hemp or flax, by which it is prevented blowing through the burner and passing off unconsumed.]

1,127.—Charles Greenawalt, of Seiberlingville, Pa., for an Improvement in Water Wheels:

I claim, in reaction tub-wheels, the use and arrangement of the half buckets, e, in the manner set forth.

I also claim the offset, m, when used with the buckets, a a, arranged and operating as set forth.

1,131.—A. C. Jones, of Philadelphia, Pa., for an Improved Pipe Joint:

I claim a package ring of flexible material, formed substantially as described and interposed between the ends of two pipes, so formed in respect to the ring that the latter shall form a self-packing and yielding joint, as set forth.

1,147.—Calvin Shepherd, of Chenango, N. Y., for an Improvement in Water Elevators:

I claim the sliding plate, f, pawls, g g', and ratchet wheels, h h', in combination with the drum, and axle and the two buckets, when the same are arranged in the manner and for the purposes described and shown.

[The object of this invention and improvement is to operate two pawls, which are used to keep either end of the bucket in an elevated position when filled, so that one pawl can be thrown off at the same time and by the same movement which throws the opposite pawl on its ratchet wheel.]

1,151.—Jacob Stuber and Frederick Frank, of Utica, N. Y., for an Improvement in Lamps:

We claim the arrangement of an air-chamber below the wick tube, formed by the perforated shell, D, communicating with the outer air through openings formed in its collar for that purpose, when such chamber is used in connection with a series of tubes or flues, through which the air is conducted to the inside of the cone, G, and by it directed in a steady current on the flame, thereby preventing flickering, by the jarring of the lamp, or from sudden currents of air striking the same.

We further claim, in combination with the devices above mentioned, the arrangement of a series of holes in the body, E, of the lamp, immediately above the flange of the cone for the admission of air to the flame, on the outside of the cone, so as to furnish the requisite amount of oxygen to complete the combustion of the oil.

And lastly, We claim, in connection with the devices above mentioned for the supply of oxygen to the flame, the perforated double button, F, by means of which the gaseous products of the flame and the oxygen are thoroughly mixed and spread, whereby a more perfect combustion is effected than by any other method now in use in circular wick lamps.

1,152.—Joseph Thomas, of New York City, for an Improvement in Lamps:

I claim, first, The construction and use, in coal-oil lamps, of two vertical or partially inclined passages, D D', terminating at the top in such a form and so arranged in respect to the flat wick tube, as set forth, as to discharge, at right angles or thereabouts, to the plane of the wick, two currents of heated air partly upon the wick and partly upon the flame, and preventing the access of the air to the edges thereof, in the manner and for the purpose specified.

Second, The enlarged ends, H and H', of the opening, G, in the cap, E, the said ends being wider than that part of the opening in the cap through which the body of the flame passes, and extending down to points level, or about level, with the top of the wick tube, as represented and described.

RE-ISSUE.

60.—C. F. J. Colburn, of Newark, N. J., for an Improved Evaporator for Hot Air Pipes. Patented Jan. 22, 1861:

I claim, first, The arrangement of the reflector, C, in combination with the evaporating vessel, A, and hot air pipe, B, as described, for the purpose of facilitating the evaporation, and to prevent the dust rising into the apartment.

Second, Making the evaporating vessel, A, or a portion of the same, of unglazed earthen ware, or some other porous material, substantially as and for the purpose specified.

Third, Constructing the vessel, A, of two parts, a and b, the part a to be made of porous material, and the part b to contain a lamp wick or its equivalent, substantially as and for the purpose set forth

Things Ancient, Quaint and Rare.

THE COMMONWEALTH MERCURY,
From Thursday, Novemb. 18, to Thursday, Novemb. 25, 1658.

ADVERTISEMENTS.

JAMES SMITH, Servant to ELIZABETH SCOT at the ſign of the White-Hart in BURY ST. EDMOND's in the county of Suffolk, upon the 12 Octob. 1658. ran away from his ſaid Dame, and carried with him in money and other things to the value of 23*l*. He is ſmall of ſtature, his Hair black and ſmooth, ſtaring upon the Crown, pale-faced, hath a ſcar of the middle of his Forehead a kind of Wart. He is about 22 or 23 years of age, no hair on his face, he went away in a grey Sute and Cloak. Whoſoever will be pleaſed to take notice of the party, and ſecure him for the poor Widows ſake, and give notice to Mr THOMAS ASHTON, Proctor in Doctors Commons thereof, ſhall be well ſatisfied for his care and pains therein.

ALl persons that have occaſſion to Travel from LONDON to MARLBOROUGH in the County of WILTS, or any place on that Road, as NEWBURY, HUNGERFORD, etc. or thereabouts, or from thence to LONDON, may conveniently go by Coach every Munday at the Poſt-houſe in MARLBOROUGH, and every Thurſday at the Red Lion in Fleet-ſtreet. By ONESEPHORUS TAP, Poſt-Maſter at MARLBOROUGH.

THe Pourtraiture of his Royal Highneſſ OLIVER late Lord Procector etc. in his Life and Death, with a ſhort view of his Government, And the manner of his Funeral Solemnity on Tuesday Novemb. 23.

A Brief Chronology of the moſt remarkable Paſſages and Transactions, which occurred since his late Renowned Highneſſ, OLIVER Lord Protector was Invested with the Government of the Commonwealth. With the Manner of his Death, and the Description of his lying in State at Somerſet-Houſe, ſet forth with a Braſſ cut, and printed in a large ſheet of one ſide.

Both ſold by ED. THOMAS at the Adam and Eve in LITTLE BRITTAIN, and at other Bookſellers Shops.

PEplum Olivarii, or, A good Prince bewailed by a good People. Represented in a Sermon, Octob. 13. 1658. upon the death of OLIVER late Lord Protector. By GEORGE LAWRENCE A. M. Miniſter of CROSSES HOSPITAL. Sold by SAMUEL THOMPSON at the Biſhops-Head in PAULS Churchyard.

THe unparallel'd Monarch, or the Portraiture of a Matchleſſ Prince, expreſt in ſome ſhadows of his Highneſſ my Lord Protector.

COmes Facundus in Via. The Fellow-Traveller, through City and Country, among ſtudents and Scholars, at home and abroad. Furniſhed with ſhort Stories, and the choiceſt Speeches of clean and innocent Wit and Mirth, for diſcourſe or private entertainment in Recreations or Journeys. By DEMOCRITUS SECUNDUS.

Both ſold by HUM. ROBINSON at the Three Pigeons in St. PAULS Church-yard.

WHereas there is a Sermon pretended to be preached at ST. GREGORIES, June 13, 1658. and fondly called the MOURNING BUSH, this is to give notice that it is a broken, falſe, and imperfect Copy, and ere long the true Copy with the Authors name will ſee the light.

THe Hiſtory of Eighty Eight, the Powder Plot, and the Fall in Black Fryers. Faithfully collected out of the Beſt Authors, and conjoined into one little Volume fit for every Family. By SAMUEL CLARK, Paſtor of BENNET FINK. Sold by JOHN ROTHWELL at the Fountain in Cheapſide.

SIr Kenelme Digby's Diſcourſe touching the cure of Wounds by the Powder of Sympathy. Rendered faithfully out of French into Engliſh by R. WHITE, Gent. Sold by R. Lownes & T. Davies in St. Pauls Church-yard.

OXYGEN ILLUMINATION.—If pure oxygen could be obtained cheap for supplying gas jets or oil lamps, lights of fourfold the brilliancy to those which we now enjoy would be obtained for artificial illumination. In Paris oxygen gas is manufactured from manganese by Messrs. Rosseau & Brothers, chemists, for sale in small quantities, and is put up in india-rubber bags. It is employed for burning in lamps for giving a powerful light.

CONSUMPTION OF GAS IN PARIS.—The consumption of gas in Paris during the year 1860, amounted to 2,477,021,471 cubic feet. In 1859, the amount consumed was 2,225,429,758 cubic feet.

REDUCTION IN THE PRICE OF GAS IN ENGLAND.—The Stamford Gas Company have reduced the price of their gas from 5s. 6d. to 5s. per 1,000 cubic feet. At Wolverhampton, the price of gas has been reduced 10 per cent., or to 3s. 9d. "This," remarks the local *Chronicle*, "is the fourth reduction during the last five years, and no doubt a large increase in the consumption will follow." The Dewsbury and Batley Gas Company have declared a dividend of 10 per cent., and carried a good surplus forward out of the profits of the year (£2,760.) The surplus already in hand was £3,755. An extension of the works to Thornhill is under consideration. New gas-works have been completed for the Londonderry Gas Company, at the water side, from plans by Mr. H. Ridley, their manager. The contractor was Mr. Denis Dogherty. There appears to have been a very rapid increase of late years in the consumption of gas in Paris. At the general annual meeting last week of the "Compagnie Parisienne d'Eclairage et de Chauffage par le Gaz," the report presented stated that the consumption had been, in 1855, 33,000,000 cubic metres; in 1857, 52,261,000 cubic metres; in 1859, 63,015,000 cubic metres; and in 1860, 70,348,600 cubic metres. The profits of the company in 1860 were £332,200, and the dividends paid during the year were 70f. per share, as compared with 60f. per share in 1859.

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CANDLES FROM COAL.—Manufactured by the New York Paraffine Candle Co. Under Meucci's Patent. The above Company having recently made great improvement in their mode of manufacture, now offer to the public a Candle superior to any other in the market. They give a softer and more brilliant light, and burn 6 hours to the pound longer than the best wax and sperm, and, considering the strength of the light, are the most economical Candles in use.

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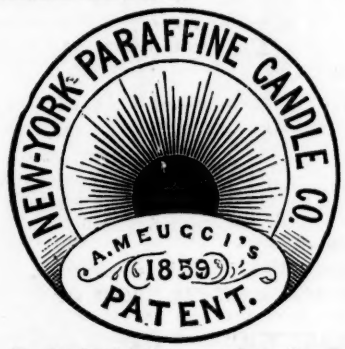
As unscrupulous persons are already offering imitations of these Candles, purchasers should bear in mind, that every box sold by this Company is stamped with the annexed trade mark, to counterfeit which is felony.



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For Engravings, see AMERICAN GAS-LIGHT JOURNAL, for June, 1860, page 245.
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MISCELLANEOUS.

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See Engravings on page 163, Vol. II. of this JOURNAL.

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GAS ENGINEERS' LIBRARY.—A few works indispensable to Engineers, Contractors, and others engaged in the construction of Gas-Works and manufacture of Gas, have been selected, out of a large stock of chemical and other works, and are recommended to the attention of those interested. See page 208, vol. II, of this JOURNAL.

For sale at the Rooms of the AMERICAN GAS-LIGHT JOURNAL, New York.

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A large and elegant assortment of CHANDELIERS, BRACKETS, &c. Gas-Pipe and Posts made for Gas Companies on favorable terms.

GAS LANTERNS.

A. & G. BRANDON, MANUFACTURERS of Street and Fancy

LAMPS,

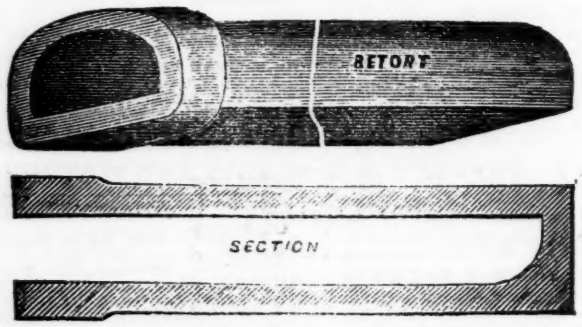
of every pattern, for Hotels, Saloons, and Public Buildings, on hand and made to order.

Cities, Villages, and Gas Companies supplied with Street Lamps, on favorable terms. Office, No. 4 TRYON ROW, City Hall Square, and Manufactory, No. 102 Mulberry street, one door from Canal street, New York.

ROOFING.

PATENT ASPHALTE ROOFING and SHIP SHEATHING FELTS, the cheapest, best, and most durable ever offered to the public. Circulars, samples, &c., will be forwarded free. Agents wanted for city and towns. None genuine unless purchased of AARON A. DE GRAUW, 242 South street, our sole agent for the United States. CROGGON & CO., London.

KING BROTHERS,
STOURBRIDGE, ENGLAND, FIRE-BRICK AND RETORT WORKS.



KING BROTHERS beg especially to call the attention of Gas Companies to the superiority of their Retorts, which are made from the celebrated STOURBRIDGE FIRE-CLAY. Mr. King has patented a Kiln for Burning Retorts, by which Patent all Cold Air is excluded from the Kiln while burning, thus rendering them

Free from Cracks and Correct in Form.

By great care in Manufacturing, combined with the advantages in Burning, a VERY SMOOTH SURFACE is obtained, rendering them less liable to carbonize.

RETORT OVENS, FIRE-BRICKS, GUARDS, SADDLES, RABITTED BURS, FLUES, AND QUARRIES, ARE ALL MANUFACTURED OF THE SAME QUALITY OF CLAY.

EVERY RETORT AND BRICK IS BRANDED "KING BROTHERS, STOURBRIDGE."

HARRIS & PEARSON,

PROPRIETORS OF

Best Glass-House Pot & Crucible Clay.

Manufacturers of Fire-Bricks, Gas-Retorts, and Glass-House Furnace-Bricks of every description.

AMBLECOTE FIRE-CLAY AND BRICK WORKS, STOURBRIDGE, ENGLAND.

CODE, HOPPER & GRATZ,

1500, 1502 and 1504 FILBERT ST., PHILADELPHIA.

MANUFACTURERS OF

Pressure Registers, Pressure Indicators, Pressure Gauges, Photometers, Governors, Station Meters, Customer Meters, (Wet and Dry,) Experimental Meters, (Wet and Dry,) Show Meters, (Wet and Dry,) Meter Provers, Centre Seals, &c.

The high reputation which we have enjoyed for more than twenty-two years, and the fact that we have manufactured a greater number of Gas-Meters than all other manufacturers in this country combined, must present itself as a security to parties desirous of securing the most reliable instruments. Having completed a most extensive addition to our Factory, and added many important improvements to our machinery, we are enabled to fill orders entrusted to us with despatch, and in all cases *guarantee entire satisfaction.* Our Patent Rotary-Valve Dry Gas-Meter is now used by upwards of Two Hundred Gas Companies, giving general satisfaction; we therefore recommend it, believing it superior to any other Dry Gas-Meter manufactured. All Meters tested separately by a sworn Meter-Inspector, and sealed when desired.

EDWARD COCKEY & SONS'
PATENT GAS-VALVES.

These Valves are formed of two Cast-Iron Cylinders, with segmental divisions, having the faces ground gas-tight—the upper cylinder turning horizontally on the lower one.

The lower Cylinder has pipes from each division, communicating with the vessels to and from which the gas is to be passed. The upper Cylinder has corresponding divisions, so arranged as to direct the passage of gas to the different segmental divisions in the lower part, and when it is turned on the face of the lower one, to alter the flow of gas from one vessel to another.

Each valve has an index-plate provided, which is to be attached to the floor, and a pointer on the cover of the Valve shows which way it is turned. Thus, the Manager of the Works can at once see in which direction the gas is passing.

There are about fifty of these Valves now in use, of sizes varying from two to twelve inches, and they are giving great satisfaction. Amongst the Works at which they are fixed, the following may be mentioned:—

BASINGSTOKE,	CHELTENHAM,	ENNISCORTHY,	FROME,	NEWPORT,	SANDWICH,
BLANDFORD	CANTERBURY,	ELGIN,	GODALMING,	RYDE,	WARMINSTER.

They are in course of erection at other important Works.

IRON WORKS, FROME SELWOOD, ENGLAND.

EDWARD COCKEY & SONS

ALSO MANUFACTURE

Purifiers, Scrubbers, Condensers, and other Improved Gas Apparatus,

HAVING PATTERNS SUITABLE FOR GAS-WORKS OF DIFFERENT SIZES.

MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS.

MANUFACTORIES

SUFFOLK ST. CLERKENWELL GREEN. & ALLEN ST. GOSWELL ST. LONDON.

BOSTON, MASS., 1 BARRETT STREET,—August 2, 1860.

RICHARD GLOVER begs to inform GAS COMPANIES and CONTRACTORS that he has always on hand a large assortment of THOMAS GLOVER'S (of London) celebrated DRY GAS METERS.

THOMAS GLOVER'S Meters have now been in use in the United States and British Provinces, for the last FOURTEEN YEARS, and are extensively used by many Gas Companies, to their entire satisfaction; and R. GLOVER can with all confidence refer to them in proof that THOMAS GLOVER'S Meters are— the most PERFECT in PRINCIPLES— the most CORRECT in REGISTRATION—and more DURABLE than any other Dry Gas Meter made in the United States or Great Britain. R. GLOVER will at all times be glad to repair any Gas Meters sent him at the above factory. If any of them are of THOMAS GLOVER'S manufacture, and of a more recent date than THREE years, he will make no charge.

DOWN & MERRIFIELD,

Nos. 340, 342, 344 and 346 West Twenty-second Street, North River, NEW YORK CITY,

MANUFACTURERS OF

WET AND DRY PATENT GAS-METERS,

Pressure-Registers, Pressure-Indicators and Gauges, Station, Show, Customer, and Experimental Gas-Meters, Centre or Hydraulic Valves, Governors, Compensators for Exhausters, and the Standard, Testing Gas-Holders* for Proving Meters, now used in the State of New York in compliance with an Act of the Legislature.

ALSO, BUNSEN'S PHOTOMETER, WITH COMPLETE APPARATUS FOR WORKING THE SAME.

* The standard of measurement of this Gas-Holder is given by Professors TORREY, of the U. S. Assay Office; JOY, of Columbia College; GIBBS, of the Free Academy, and several other distinguished scientific gentlemen.

JOHN J. GRIFFIN & CO.,

No. 7 BEEKMAN ST., and 76 WEST THIRTY-SEVENTH ST.,

NEW YORK CITY,

MANUFACTURERS OF WET AND DRY GAS-METERS,

Station-Meters, Proving-Machines, Show-Meters, Test-Meters, Pressure Indicators, &c.

All of our Work is Guaranteed to be of the First Quality, as well as the material, and for this we can refer to numerous Gas-Light Companies.

JOSEPH LENNIG & CO.,

Nos. 313 & 315 NEW MARKET St., above Vine St., Philadelphia, Pa.,

MANUFACTURERS OF

WET AND DRY

PATENT

GAS-METERS,

STATION,

SHOW, CUSTOMER,

AND

EXPERIMENTAL

METERS.

PHOTOMETERS,

PRESSURE-REGISTERS,

INDICATORS,

AND

GAUGES,

GOVERNORS, METER-PROVERS,

CENTRE-SEALS,

FLUID GAUGES, &c.

The flattering Testimonials we are receiving from Gas Officers, accompanied with expressions of such general satisfaction, and the fact of a tried experience for fourteen years, must present itself as a security to parties desirous of securing the most reliable Instruments. We therefore recommend our Patent Dry Gas-Meter, believing it superior to any Meter manufactured. Messrs. J. LENNIG & Co. confine their sole attention to the business of GAS-METER making.

Our materials are the best in use; the strictest attention is given to workmanship, and we guarantee entire satisfaction to all purchasers.

Purchasers may at any time inspect our Works, and the materials of which our Meters are manufactured. We are fully prepared to execute all orders, upon the shortest notice, and it will be to the interest of parties to call upon us.

☞ **Each Meter Tested Separately by a Sworn Inspector, and Sealed when desired.** ☜

METERS REPAIRED AND FORWARDED WITH DESPATCH.

GAS, STEAM, SMOKE,

PURE WATER & SOIL PIPE,

FROM

JOSEPH CLIFF,

Wortley Fire-Brick Works, Leeds, England.

T. W. PARMELE, Agt.,

No. 4 Irving Place, N. Y.

WARREN'S PATENT WATER & ALARM GAUGE,

For Protecting the Flues and Preventing Steam-Boiler Explosions.

This is a reliable High and Low Water Detector, arranged so as to render it one of the best Water Gauges ever attached to a Steam-Boiler; always presenting before the Engineer at sight the exact height of the water, and if, by oversight or by sudden leakage, the water gets low in the boiler, it will cause an alarm before the water gets below the flues, thereby preventing an explosion. This Gauge can be made to alarm at any point desired as a High Water Detector, thereby preventing the water from getting to that height as to be forced into the cylinder of the engine, often causing serious accidents. Thus it is a High as well as a Low water Detector. For sale by

WARREN & BANKS,

158 Centre st., corner of Canal st., New York, Where a Gauge is constantly in operation.

JOHN RUSSELL & CO.,

PATENT TUBE MAKERS,

THE OLD TUBE WORKS, WEDNESBURY, AND THE ALMA WORKS, WALSAL, STAFFORDSHIRE,

69 UPPER THAMES ST., & 5 CHARLES ST., SOHO, LONDON;

AND 35 GRANBY ROW, MANCHESTER, ENGLAND.

The original Manufacturers of WROUGHT-IRON GAS TUBES, and the Inventors of the Lap-welded Tubes for Locomotive and Marine Boilers. All kinds of TUBES and FITTINGS, whether for Gas, Steam, or Water. Galvanized and Composition Tubes. Chandeliers, and every kind of Brass work for Gas and Steam.

STOCKS, DIES, AND TAPS OF ALL SIZES. CAST-IRON PIPE AND GAS-METERS.

All Goods Warranted.

THE

STERLING GAS-REGULATOR,

Improves the Light and Saves a Large Per Centage of Gas.

MANUFACTURED BY THE

WHEELER & WILSON SEWING MACHINE COMPANY.

It is well known that Printers require the best and most brilliant light In proof of the superiority of these Machines over all others, the following New York establishments are using them, and testify to their excellence:—New York Times, New York Herald, New York World, New York Tribune, New York Sun, Journal of Commerce, Courier & Enquirer, Evening Post, The Zietung, Dispatch, Leader, Scientific American, Advertiser and Spectator, Independent, Daily News, Harper's Monthly and Weekly, Transcript, Mercury, Atlas, Life Illustrated, Albion, Spirit of the Times, AMERICAN GAS-LIGHT JOURNAL, Christian Enquirer, Churchman, Church Journal, Christian Advocate, Christian Ambassador, Christian Intelligencer, Observer, Sunday Times, Sunday Courier.

By order of the New York and Brooklyn Common Councils, these Regulators are now used in the City Halls, Police Stations, Markets, and other Public Buildings in both cities.

They are Warranted by the

WHEELER & WILSON SEWING-MACHINE CO.,

505 BROADWAY, NEW YORK,

To keep in order, and always maintain the pressurs of the Gas at the lowest point for a brilliant light and economical combustion. They are so constructed that *under no circumstances can the Mercury get into the Meters, or in any way injure them.*

GENGEMBRE'S PATENT

NON-FREEZING AND NON-EVAPORATING

GAS-METER FLUID.

By the use of this Fluid, the WET GAS-METER of ordinary sonstruction is rendered the most perfect and most reliable Gas Measuring Instrument ever offered to Gas Companies. In winter the Meter will continue to work equally well, *however exposed it may be;* and in summer the level of the Fluid remaining constant without refilling, the measurement of the Gas will be both uniform and constant.

The use of this Fluid is both easy and economical, and Gas Companies desirous of using it will be licensed on liberal terms. For further particulars, and certificates of parties having used the same for over three years, and for city rights, apply to

A. DOISY, Box 1180,

General Agent and Attorney for GENGEMBRE'S PATENT.

N. B.—No Sales of Territorial Right, or Licenses for using my Patent will be valid, without being ratified by my Signature, as I have no Agent authorizeed to execute the same.

H. P. GENGEMBRE, PATENTEE, Box 48, Alleghany City, Penn.

BURTIS' PATENT COMPENSATING COUNTERBALANCE FOR GASOMETERS.—This Improvement consists in making the attachment to the Gas-Holder by counterweights in such a manner as to effectually prevent it from getting out of level so as to bind, and also to prevent any escape of Gas at Cup or Hydraulic seal, where the Holder is on the Telescopic plan. Holders that work out of level are thus evenly balanced, and prevented from binding or lodging against Tank-wall and falling down, thereby being rendered unfit for service. Where Holders or sections of Holders cannot be used on account of the above difficulties, this arrangement will remove them, and place the Holders in good working order; moreover, with this attachment, deep tanks are not necessary.

BURTIS' COUNTERBALANCE has been in use for three years at the Gas-Works, Chicago, Ill. Its resistance to high winds and snow-drifts is alone sufficient to recommend its general adoption. For engravings, see AMERICAN GAS-LIGHT JOURNAL for June, 1860, p. 221. Address P. T. BURTIS,

Engineer Gas-Works, Chicago, Ill.

GAS THERMOMETERS FOR ascertaining and regulating the temperature of the gas while passing through the purifiers into the station meters. For sale at the Rooms of the AMERICAN GAS-LIGHT JOURNAL.

UNION WIRE-WORKS.

ROBERT McMURRAY & CO., No. 29 Fulton Street, New York, Manufacturers of Copper, Brass, and Iron Wire Cloth for Gas Works, all kinds of Foundry Riddles, Sieves, and Screens. Improved Wire Window Shades, Wire Bolting Cloth, Duster-Wire, Wire Cloth for fanning machines, Rosin, &c., Locomotive Wire, Fire Guards, Ornamental Wire Work of every description. Patent Improved Wove and Laid made, repaired and designed to order.

McKINNY & KELLY,

MANUFACTURERS OF

COAL-SCOOPS AND COKE-BARROWS,

FURMAN ST., near Fulton Ferry, Brooklyn, N.Y.

F. BUTTS & CO.,

(Successors to BUTTS & KENDALL,)

DEALERS IN THE CELEBRATED

STERLING COAL,

PITTSBURGH AND OTHER GAS-COALS,

CLEVELAND, OHIO.

We beg to call the attention of Gas-Light Companies to the following, from which (and others), and the universal expression of Gas Men, as to the superior quality of

STERLING COAL,

we believe that it is THE BEST COAL IN THE COUNTRY.

From the Manhattan Gas-Light Co., N. Y.

Gentlemen—Yours of the 9th inst. is received. The "Sterling Coal" received from you during the past year worked very satisfactorily—averaging 9520 cubic feet of 15 candle Gas per ton of 2240 lbs., and 41 bushels of Coke weighing 1465 lbs.

We consider it among the best of American Gas Coals, for the quantity and quality of the Gas produced, and also for the excellent quality of its Coke.

I am, Gentlemen, Your Obedient Servant,

CHARLES ROOME, *President.*

From the Rondout and Kingston, N. Y. Gas-Light Company.

Gentlemen—The 600 tons of Coal ordered from you in August, 1859, has now been in use over four months, to my entire satisfaction.

Its average yield is 4 40-100 feet, and a good strong light. The Coke produced equal, both in quality and quantity, to best English Coking Coals. It burns very freely, with little clinker. In purification it is economical, using no more lime than New Pelton. It is superior to any American coal I ever used. I shall be pleased to give you any further information at my office in New York.

WM. W. HAGUE, 552 Broadway.

From the Sandusky, O. Gas Co.

Gentlemen—This Company has used your Sterling Coal since July 3d, 1856, and are still continuing the use of it with satisfaction to the Company and consumers. The average product has been 8,620 feet of Gas per ton of 2,000 lbs., and 37 bushels of Coke of very superior quality. The Gas is as good as that obtained from Pittsburgh coal. I consider it the best coal ever used in our works.

I am, Gentlemen, Yours Respectfully,

WILLIAM HUDSON, Sup't and Sec'y.

From the Toledo, O., Gas-Light Co.

Gents:—Your favor of the 18th inst. to hand and noted.

The Sterling Coal received from Messrs. Butts & Co., the last summer and fall, fully sustains the character it has as a Gas Coal, from previous use in our works. We think the quality of Gas is very good, a little better than that produced from the coal had of them the year previous—yielding 8,666 feet per ton of 2,000 lbs., and 36 bushels of Coke, of very good quality, well adapted to our use.

Respectfully Yours,

GEO. SPENCER, President.

From the Buffalo, N. Y., Gas-Light Co.

Messrs. F. BUTTS & Co.—The Sterling Coal we have had from you we find to be an excellent Gas Coal. The yield of both Gas and Coke is good. The illuminating power of the Gas is high and the quality of the Coke is very good.

ROBERT ROBSON, Foreman Gas-Works.

From the Cleveland, O., Gas-Light & Coke Co.

Gentlemen—This Company has used between 3,000 and 4,000 tons of your "Sterling Coal," and are still using it with satisfactory results. We find the average product of a ton of 2,000 lbs. is about 8,800 feet of Gas, and about 37 bushels of Coke. The Gas is of good illuminating power and quite free from sulphur or other impurities, one bushel of lime purifying 9,000 feet, and the Coke of very superior quality.

The yield of Gas is about the same as from the Pittsburgh Coal, and the Coke is better adapted to our use.

Yours truly,

T. DWIGHT EELLS, Secretary.

From the Albany, N. Y., Gas-Light Co.

Messrs. F. BUTTS & Co.—*Gentlemen*—We have been using your "Sterling Coal" at these works for two years, finding it all that is important in Gas-making Coal, as respects yield and quality of Gas, and freedom from Sulphur—as much so as any of the Coking Coal now in use. We are disposed to contract for a further supply of the same quality. Very Respectfully,

PAUL A. SABBATON, Sup't.

From the Troy, N. Y. Gas-Light Co.

Messrs. F. BUTTS & Co.—*Gentlemen*—The Coal we have used the past year at our works has been mostly "Sterling." It has given us full satisfaction in every respect. S. S. DAUCHY, Sup't.

The following analysis of Sterling Coal was made by Prof. J. LANG CASSELS, Professor in the Cleveland, O., Medical College, who stands at the head of his profession as a Chemist, and any statement made by him can be relied upon with safety.

Sp. gr.	1,288	
Hygremaeric Moisture,		1.85
Volatile Combustible Matters,		34.15
Coke, (clear and porous,)		64.00
		100.00
Fixed Carbon in the Coke,	62.00	
Ashes, (yellowish white,)	2.00	
	64.00	

COMPOSITION OF ASHES.

Silex,	0.80
Al mini,	0.45
Sulphate of Iron,	0.75
	2.00
Per centage of Sulphur,	0.2

J. L. CASSELS, M. D.,

Prof. of Chemistry, Clev. Med. Col.

P. S.—The specimen from which the above analysis was made, was taken by myself from a car load, and may be regarded as a fair average; in fact this Coal is very uniform in its characteristics. It also yielded 4 per cent. more gas than the Pittsburgh Coal. J. L. C.

We would also refer to Gas-Light Companies in the following places:

NEW YORK CITY, (Manhattan and New York Cos.,) BROOKLYN, ALBANY, TROY, WEST TROY, ROCHESTER, OSWEGO, RONDOUT, KINGSTON, ALBION, BROCKPORT, SENECA FALLS, ELMIRA and LYONS, in the State of New York; CLEVELAND, TOLEDO, SANDUSKY, NORWALK and OBERLIN, in Ohio; DETROIT, ANN ARBOR, GRAND RAPIDS and KALAMAZOO, in Michigan; COBURG, in Canada; Chicago, Ill., and two Companies in MILWAUKIE, Wisconsin.

The extensive Mines in Pennsylvania, known as the Sterling Hills, (which are the highest in that part of the State,) are wholly under our control, and the coal is mined and sold only by us or our agents. As the coal has improved the further we have got in, and being several hundred yards further in than last season, with about a hundred feet more earth over it, *the quality of Coal we mine this year will be better than ever.* Some Coals are good in one or two particulars, and defective in others; but in combining all the qualities desired in a Gas-Coal, we know of none equal to the STERLING. Getting it to this place by Railroad, a supply can be had during the Summer months, (as well as at all other times,) which is not the case with coals dependent upon high water for transportation, as are those shipped from Erie, Pa. Having increased our mining facilities, we are prepared to ship on a more extensive scale than heretofore, and should be pleased to receive your orders.

☞ Having discovered that certain unprincipled Coal Dealers are endeavoring to sell an inferior article of Coal, under the name of STERLING, we deem it our duty, as well for your interest as for ours, to notify you, that you may be on your guard in purchasing what you might think was STERLING. *There is but one Sterling Coal Mine, and that Mine we have the full and entire control of;* and Gas-Light Companies can obtain the GENUINE STERLING COAL only by ordering direct from us, or F. WELLINGTON, Syracuse, N. Y., who is our only agent for that State.

F. BUTTS & CO.

CLEVELAND, O., March 1st, 1861.